14th IconSWM-CE & IPLA GF 2024

Sustainable Waste Management & Circular Economy 2024

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International Society of Waste Management Air and Water

Abstract Book

Proceedings of Abstracts of the 14th International Conference of Sustainable Waste Management & Circular Economy

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Dr. T. Sowdamini, Dr. N. Lalitha

GITAM (Deemed to be University), Visakhapatnam, AP, India

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International Society of Waste Management, Air and Water (ISWMAW), India
Kolkata 700041, iswmaw@gmail.com, www.iswmaw.com

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The registered office address is: 29/6, Jadunath Ukil Road, Kolkata 700041, India
For communication send mail to: iswmaw@gmail.com; iconswm.ce@iswmaw.com, iconswmce@gitam.edu;

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Prof. Sadhan Kumar Ghosh

Prof Ghosh is recognised among Top 2% Scientists in the World in 2024-year basis 2023 by Stanford University having collaboration in more than 45 countries. Based on his strong publication record, the impact of his work, and the notable quality of his scholarly contributions have placed him in the top 0.5% of all scholars by ScholarGPS. His rankings in which he has been awarded Top Scholar status based on his accomplishments over the totality of his career (lifetime) and/or over the prior five years: Top Scholar – Lifetime rank: #180 in Waste management; Top Scholar - Prior 5 Years ranks: #16 in Waste management; #522 in Sustainability & #51,020 Overall (All Fields).

He is the Director General, Sustainable Development & Ccircular Economy Research Centre, ISWMAW, India and the Founder Advisor, Centre for SD & Res. Efficiency Mngt., Jadavpur University, Kolkata, India. He is globally renowned personality in the field on Waste Management, Circular Economy, Green Manufacturing, Supply Chain Management, Sustainable Development, Co-processing of Wastes, Plastics & E- Waste management, Recycling, ISO Standards & TQM. He served L&T Ltd. & Gramophone Co of India Ltd, formerly he served as the Dean of Faculty of Engg. and Technology, Head & Professor in mechanical engg, Jadavpur University, India and the Director, CBWE, Ministry of Labour and Employment, Govt. of India. He provided expert services to more than 150 industry units in India, Taiwan, Denmark, and the UK. He is the Editor-in-Chief of the Journal of SWTM and Asso. Editor of the Journal of MC&WM, more than 40 books by CRC press, Springer Singapore Inc., Oxford Publishing House and others, wrote ten books & more than 300 national and international articles and book chapters.

He received Distinguished Visiting Fellowship 2012 by the Royal Academy of Engg, UK and The Boston Pledge & NABC 2006 Award in 2006, Houston, USA. He received 3 patents in India and Bangladesh on "eco-friendly plastics recycling machine [Patent no.202532 Dt. 02/03/2007] and "Automatic High Speed Jute Ribboning Machine" [Patent no. 1005146 dt. 17/02/2014]. He developed & established "Policy on Anti-Plagiarism, Jadavpur University, 2019". He conceptualised a mission, "Catch Them Young: Zero Waste & Circular Economy in Campus" in which 2,00,000 students and teachers are working with him from 152 schools in India targeting to make 20 million people aware on waste management & circular Economy in India by 2025. In International arena, Prof. Ghosh international consultant/expert of the (UNCRD)/DESA), APO, Japan, CPC, Taiwan, The Institute for Global Environmental Strategies (IGES), & JAIF Japan and SACEP, Sri Lanka. He has been the Principal Investigator of 27 international funded projects by EU, British Council, Erasmus, Royal Academy of Engg., SINTEF, Norway;, Hungary Govt., IGES, Georgia Govt., etc and 25 national funded research projects. He is the member in the Indian mirror committee of ISO TC 323 - Circular Economy, ISO/TC 297 - Waste collection and transportation .Management and ISO TC 207- Environment Management and was the convener of ISO TC 61 WG2. He is the Chair of 14th IconSWM-CE 2024. Please Visit: https://www.youtube.com/@Prof.SadhanEditor/videos; Available at: sadhankghosh9@gmail.com. For details. please visit : www.sadhankghosh.com
ResearchGate: https://www.researchgate.net/profile/Sadhan-Ghosh and ORCID 0000-0002-9128-5202.

Prof. Raja P Pappu. B.Engg, MSc, PhD, MBA, Dean of GITAM School of Business, GITAM Deemed to be University

Prof. Raja is a Professor of Entrepreneurship. He is currently the Dean of GITAM School of Business at GITAM Deemed to be University. His work is predominantly is in the areas of Entrepreneurship and Circular Economy. Prof. Raja's academic background includes a B. Engg degree from Nagpur University, an MSc in Telecommunications, a PhD, and an MBA from Aston University in the United Kingdom. Currently, he is involved in the implementation of the grants Technology Enabling Centre, STI-HUBS and NIDHI i-TBI from the Department of Science and Technology (DST) and the Going Global Collaboration Grant in partnership with Aston University and ISMWSM offered by the British Council. In the past, he has also successfully worked on the Royal Academy of Engineering (RAE) and Global Challenges Research Fund (GCRF) grants, emphasising sustainability in small and medium-sized enterprises (SMEs). He is also the co-founder and Director of Skilliantech Limited, a global CMMI-Level3 company headquartered in London.

Prof. Raja was the recipient of the esteemed John Flood Telecommunications Prize from Aston University in 2005, received the Aston 50th Anniversary Scholarship Award in 2016, and his company received the Economic Times - Global Indian MSME of the Year Award in 2023. Prior to his academic career, he co-founded various businesses in the United Kingdom, including Healthcare, Hospitality and Consulting, mentored several startups, and actively contributed to the entrepreneurial landscape. Prof. Raja has participated in trade missions led by former British Prime Minister Rt. Hon. Theresa May and Sir Malcolm Grant, the NHS (National Health Service) Chairman.

Dr ASIT AICH, BE (Civil), ME (Environment), PhD Engineering, MBA, Chartered Engineer

Scientist at Dr Shyama Prosad Mookerjee National Institute of Water & Sanitation (SPMNIWAS), Department of Drinking water and Sanitation, Ministry of Jal Shakti, Govt. of India. Former Head of Civil Engineering Department, Siliguri Institute of Technology (A Techno India Group Institution).Former Superintending Engineer, Govt. of West Bengal, Urban Development & Municipal Affairs Department, West Bengal India. Published three book chapters, five International Journal papers & more than twenty international conference papers.

Professor Sai Sudhakar Nudurupati, Asso. Dean & Professor of GITAM School of Business, GITAM Deemed to be University

Professor Nudurupati is currently serving as associate dean and senior professor in the GITAM School of Business and leading research and development activity by increasing scholarly activity and outputs. He has worked on nine research projects worth of Rs. 4.9 Crores. Professor Nudurupati gained his PhD from the University of Strathclyde, UK by obtaining an Overseas Research Scholarship selected by Committee of Vice Chancellors and Principals (CVCP) and funded by Department of Education and Employment, UK. He received an Outstanding Doctoral Award from Emerald and European Foundation for Management Development. Prior to joining GITAM, Professor Nudurupati has worked for 11 years at Manchester Metropolitan University, Exeter University & Strathclyde University in various teaching and research roles. During this period, he has worked on various projects with clients including Pirelli Tyres Ltd., British Aerospace Engineering Systems, Mastclimbers, Allied Distillers Ltd., Daks Simpson, etc. He has published over 35 articles in reputed international journals and magazines. He received a best paper award from Emerald and The J D Scaife Premium Prize from Institute of Engineering Technology for his publication on “Driving Continuous Improvement”. Professor Nudurupati has supervised seven PhD research scholars through successful completion, chaired two PhD vivas and adjudicated four PhD and two MPhil theses in the UK, Italy & Malaysia. He is currently serving as an associate editor for the International Journal of Productivity and Performance Management and serving on the editorial boards of Production Planning and Control; Measuring Business Excellence. He served as an external examiner at Manchester Business School on their global MBA programme. He has been a resource person in several

Management Development Programmes and Faculty Development Programmes. He has served as an organising committee member in a number of international conferences. Prior to taking his academic roles.

Dr. Namuduri Srinivas, Professor & Head in the Department of Life Sciences, GITAM School of Science, GITAM (Deemed to be University), Visakhapatnam.

Professor Nudurupati has spent 5 years in SGB, UK implementing continuous improvement projects. This experience led him to gain Lean Six Sigma Transactional Black Belt certification with the British Standards Institute. Dr. Namuduri Srinivas working as a Professor & Head in the Department of Life Sciences, GITAM School of Science, GITAM (Deemed to be University), Visakhapatnam, and former Coordinator for the DST-FIST program in Environmental Science (2013-18). He is having more than 27 years of teaching experience for PG students in Environmental and Life Sciences and have guided 15 Ph.D. students, 04 M.Phil. dissertations, and six students currently working in the thrust area of Environmental Remediation.

As a part of Environmental sustainability research developed an Organic Pellets from food waste for the benefit of farmers to enhance their farms soil health and productivity of crops specifically vegetable crops. This concept popularizing among farmer communities of plains and tribal areas by conducting workshops and providing hands on experience at GITAM facility. As a part of Environmental Remediation research an attempt is made in optimizing the methodology for sustainable utilization of sewage sludge for safe disposal based on the characteristics and removal efficiency is in progress. Combined two techniques i.e. electrokintic coupled with phytoremediation to achieve the objectives in a cost-effective way. He published research papers in Scopus/WoS journals and completed six major projects funded by UGC, DST, UGC-DAE and the National University of Singapore. Besides, completed three major industrial projects in air pollution and more than 25 consultancy works for Thermal power plant, Port Trust, and local industries. Received Best Teacher and Best Researcher Awards from GITAM (Deemed to be University) in 2010. Organized national and international seminars/conferences in environmental science and conducted several environmental awareness programs for students, the public, and industrial employees.

Dr. Rahul Baidya is a Professor & Assistant HoD in Department of Mechanical Engineering at Institute of Engineering & Management, School of University of Engineering and Management Kolkata, India.

He has completed his Masters and PhD (Engineering) from Jadavpur University. *He was a Research Fellow (Visiting), Aston Business School, Aston University, Birmingham, UK during 2014 and 2015.* He is an executive member of International Society of Waste Management, Air and Water, Kolkata. His research interest includes circular economy, co-processing, resource and energy recovery from waste, supply chain management and optimization engineering. He has published over 60 papers, in refereed journals and in international conference across the globe. He has worked as co-investigator in number of international research projects funded by UKIERI, Royal Academy of Engineering (RAE), British Council and Erasmus+. He has also acted as convenor and scientific committee member of numerous international conferences. He has delivered numerous invited talks in different seminars and conferences.

Dr. Y.L.P. Thorani B.SC., M.Sc., M.Phil., PhD., MBA, Area Chair of Operations and Supply Chain, & Associate Professor, GITAM School of Business, GITAM Deemed to be University.

Dr. Thorani is an accomplished academic and researcher specializing in Operations and Supply Chain Management. She currently serves as the Area Chair of Operations and Supply Chain at GITAM School of Business, Visakhapatnam, GITAM Deemed to be University. She holds a Ph.D. and M.Phil. from GITAM Deemed to be University and an MBA from Andhra University. Her research interests lie in Decision Science, Circular Economy, Green Supply Chain, Supply Chain Analytics and Multi-Criteria Decision-Making techniques, with a focus on integrating Fuzzy and Neutrosophic sets. She further enhances her expertise with a certification in Data Science for Business Decision Making from IIM Kozhikode.

She worked on 2 major projects worth of Rs. 1.28 Crores, funded by the British Council, Going Global Collaboration Grant in partnership with Aston University and other partners in India on Circular Economy in small and medium sized enterprises to combat climate change issues and on Pilot for master's Programme in Circular Economy and delivered the module on Research methodology in Aston University. She has a published over 20 articles in reputed journals like Journal of Cleaner Production, Springer Nature, Property Management. She received a IconSWM-CE Excellence Award 2023 for best paper presentation. She has been a resource person in the several Management Development Programmes and Faculty Development Programmes. She is the Director in organizing the workshops and organising committee member in the national and international conferences.

Dr. T. Sowdamini, Associate Professor, Area Chair of OD & HR, GITAM School of Business, GITAM Deemed to be University.

She is an esteemed academic and professional in the field of Human Resource Management (HRM) with over 20 years of experience. Currently serving as an Associate Professor and Area Chair for Organizational Development and Human Resources at GITAM School of Business, Visakhapatnam, she brings a wealth of knowledge and experience to her roles. Her educational background includes a Ph.D. from Andhra University, specializing in Six Sigma practices, as well as an Executive Education Certificate in HR Analytics from IIM Rohtak. She has also attained an M.Phil. from Madurai Kamaraj University, an MBA from Pondicherry University, and an M. Com from Andhra University. Dr. Sowdamini's expertise spans across academic and industry interfaces, particularly in implementing HR analytics, Six Sigma methodologies, and employee development strategies. Her research contributions are substantial, with over 25 peer-reviewed publications in high-impact journals, including SCOPUS and ABDC. Additionally, she actively contributes to professional conferences and events, where she has served in roles such as convener for national management meets and co-convener for international conferences.

A committed mentor, Dr. Sowdamini guides several Ph.D. scholars, focusing on topics like workplace behaviour, employee resilience, and HR practices in sectors like pharmaceuticals and engineering education. Her consulting engagements include HR audits and employee satisfaction surveys for notable organizations such as Dredging Corporation of India and Toyotsu Rare Earths (India) Pvt Ltd. Dr. Sowdamini is a life member of professional bodies like NIPM, ISTD, and GHRD, facilitating her interactions with industry professionals and contributing to collaborative efforts for student internships, placements, and curriculum enhancements. Her commitment to teaching excellence is reflected in her innovative pedagogical approaches, which include active learning, cross-disciplinary infographics, and student-led discussions. Recognized with awards such as the Best Educationist Award in 2017, she continuously seeks to enrich her students' learning experiences and prepare them for the complexities of modern organizational environments. She envisions transforming GITAM's HRM department into a globally recognized hub by driving curriculum innovation, fostering strong industry connections, and prioritizing the development of both faculty and students. Her commitment to continuous learning and advancing HR practices positions her as a dynamic educator in the field of HRM.

Dr. N. Lalitha Ph.D , Assistant Professor, GITAM School of Business, GITAM, Visakhapatnam

Dr. Nammi has been in teaching from 24 years and handled many administrative of the Department, Chairperson UG program, Nodal Teacher - Gender Sensitization, Faculty Mentor- Finance Club, Coordinator-Management Clubs, Faculty Mentor Coordinator, Faculty Mentor for Marketing and Finance-Management Fests, Assistant Director-Directorate of Academic affairs, and Member-Student Affairs in reputed academic institutions in India during her career. She also handled position as Director, Academic Planning, Skyline University Nigeria along with teaching responsibilities as part of international assignment. With a Ph.D. from Andhra University on "Non-performing Assets – A comparative study between private and public sector banks, Dr. Lalitha has been teaching Post-Graduate and Under-Graduate students Financial Accounting, Cost Accounting, Management Accounting, Banking Theory & Practice, Entrepreneurship, Indian Business Environment, Strategic Financial Management, Financial Institutions, Markets & Derivatives and Merchant Banking and Financial Services. 4 doctoral candidates have been working under her supervision, she presented several research papers in national and international conferences and published in national and international journals and her area of interest is on banking sector, financial services and markets, behavioral finance, circular economy and sustainable practices. She delivered sessions on career opportunities and industry academia interactions. She also shared insights as conference chair for international and national conferences. She has a Ph.D in Finance, M.Com from Andhra University, Visakhapatnam, and Andhra Pradesh, India. In addition, she also has an MBA in finance from Pondicherry University, India. She has also done many certification courses in the areas of accounting and finance.

Editorial

The immediate need is a "strong, ambitious and just" treaty to cut down on the mass-produced plastics which are helping fuel the climate crisis. For achieving the sustainable development in the society, a multipronged approach is necessary. More than two billion tonnes of municipal solid waste (MSW) are generated each year across the globe. Apart from the municipal wastes, the human activity generates significant amounts of agricultural; construction and demolition; industrial and commercial; healthcare and hazardous wastes. This waste is produced on farms and building sites and in factories and hospitals. Despite some concerted efforts, little has changed. If anything, humanity has moved backwards - generating more waste, more pollution and more greenhouse gas (GHG) emissions. Billions of tonnes of municipal waste is still being generated every day, and billions of people still don't have their waste collected while treatment and scientific disposal are quite far.

Waste is hugely diverse and there are different ways of categorising it, for example by:
• Material, e.g. food waste or plastic waste;
• Product type, e.g. e-waste (electrical and electronic waste) or end-of-life vehicles, which contain multiple materials;
• Source, e.g. MSW, which contains multiple product types and materials.

Municipal solid waste is generated by householders; retailers and other small businesses;public service providers; and other similar sources. Managing MSW is generally a local service and is commonly the responsibility of local government. Comparatively municipal solid waste is only a small part among all types of wastes generated. Enormous amounts of non-municipal waste are generated each day, for example:

- Construction and demolition waste
- Industrial waste
- Agricultural waste
- End-of-life of Vehicles,
- Solar Panel waste,
- Biomedical waste

MSW typically includes food waste; packaging; household items including broken furniture and electronic goods; textiles and shoes; personal hygiene products and a few others. Its composition varies from place to place and may be affected by the seasonal variation, weather conditions, natural calamity and economic recessions or other major events and trends. Some products or materials found in the MSW stream are of particular concern. This is owing to rapid increases in their amounts or difficulties in collection, treatment, and other aspects of waste management aimed at meeting standards for protecting health and the environment. Examples of these materials are:

- Hazardous chemical waste
- Electrical and electronic waste (e-waste)
- Textiles
- Plastics
- Food waste
- End-of-life vehicles and waste from mechanics' garages
- Battery Waste
- Biomedical waste

The management of MSW poses unique challenges due to its sheer volume, continual growth, diverse composition, ubiquity in human settlements, variability and influence by cultural change, and the intricate web of social, economic and environmental impacts that arise from its management.

The Global Waste Management Outlook 2024, stated the Waste and the triple planetary crisis as follows:

1. Climate change: Transporting, processing and disposing of waste generates CO2 and other greenhouse gases and airborne pollutants that contribute to climate change.

2. Biodiversity loss: Indiscriminate waste disposal practices can introduce hazardous chemicals into soil, water bodies and the air, causing long-term, potentially irreversible damage to local flora and fauna, negatively impacting biodiversity, harming entire ecosystems, and entering the human food chain.

3. Pollution: Between 400,000 and 1 million people die every year as a result of diseases related to mismanaged waste that includes diarrhoea, malaria, heart disease and cancer (Williams *et al.* 2019).

The extraction of natural resources has to be reduced while the use of renewables needs to be increased. The need of effective waste management and implementation of circular economy strategies are significant in today's global requirements. Technologists, Scientists, policy makers, industries, and other stakeholders have been trying to achieve the sustainable environment while a group of nations are involved in damaging the environment by their power. The huge amount of wastes, the emission generated and damage to the mankind impacting significantly on the eco system from the war. It has to be stopped for the interest of the people and environment as a whole in a broader prospective having a paradigm shift from own interest. We are rapidly approaching dangerous tipping points for every aspect of human life, from our health and safety, our natural environment, our economies, to our property and infrastructure. We have to act for achieving. Scientists are observing changes in the Earth's climate in every region and across the whole climate system, according to the latest Intergovernmental Panel on Climate Change (IPCC) Report, released in August 2021. Many of the changes observed in the climate are unprecedented in thousands, if not hundreds of thousands of years, and some of the changes already set in motion—such as continued sea level rise—are irreversible over hundreds to thousands of years. Reduction of GHG emission is one of the vital areas which need to be focused.

Significant interest has been seen in recent part to curb the use of fossil fuels in different nations while the installation and use of the renewable electricity generation by energy sources are increasing year by year. In 2021, the total amount of electricity generated from renewables was 7 858 TWh. Renewable hydro accounted for about 55% of this (4 275 TWh), followed by wind energy (1 838 TWh), solar energy (1 034 TWh), bioenergy (615 TWh), geothermal energy (95 TWh) and marine energy (1 TWh). Bioenergy generation was divided as follows: 429 TWh (70%) from solid biofuels; 92 TWh (15%) from biogas; 86 TWh (14%) from renewable municipal waste; and 7 TWh (1%) from liquid biofuels. India's total renewable energy installed capacity surged by an impressive 24.2 GW (13.5%) in just one year, reaching 203.18 GW in October 2024, up from 178.98 GW in October 2023. Additionally, when including nuclear energy, India's total non-fossil fuel capacity rose to 211.36 GW in 2024, compared to 186.46 GW in 2023.

As in other recent years, Asia accounted for most growth in renewable electricity generation. Asia led the world in renewable energy expansion in 2023, accounting for 69% of the 473 GW of new renewable capacity added globally. China was the driving force behind this growth, increasing its capacity by 63% to reach 297.6 GW.

- **India**: As of October 2024, India's renewable energy capacity reached 203.18 GW, which is more than 46.3% of the country's total installed capacity. This growth is driven by solar, wind, hydroelectric, and biopower.
- **Japan and Korea**: Both countries are committed to offshore wind as a growth strategy.
- **Southeast Asia**: The International Energy Agency (IEA) expects Southeast Asia's role in the global energy system to grow strongly over the next decade.

Global annual renewable capacity additions rise from 666 GW in 2024 to almost 935 GW in 2030. Solar PV and wind are forecast to account for 95% of all renewable capacity additions through 2030 because their generation costs are lower than for both fossil and non-fossil alternatives in most countries, and policies continue to support them. Hydropower contributes 20-30 GW annually over 2024-2030 as emerging and developing economies (especially in Africa) gradually tap into their vast potential. Annual capacity additions for bioenergy and other renewables are expected to reach roughly 12 GW by 2030. Global renewable capacity is expected to increase over 5 520 GW during 2024-2030, 2.6 times more than deployment of the last six years (2017-2023). Utility-scale and distributed solar PV growth more than triples, accounting for almost 80% of renewable electricity expansion worldwide.

There is a 50-50 chance that global warming will exceed 1.5°C in the next two decades, and unless there are immediate, rapid and largescale reductions in GHG emissions, limiting warming to 1.5°C or even 2°C by the end of the century will be beyond reach. The achievement of the net-zero pledges that an increasing number of countries are committing to would improve the situation, limiting warming to about 2.2°C by the end of the century. However, the 2030 commitments do not yet set G20 members (accounting for close to 80 per cent of GHG emissions) on a clear path towards net zero. Effective Waste Management and Circular economy are related actions too to combat with the situations.

EPCD2 (Extract-Produce-Consume-Dispose-Deplete) in the concept of linear economy has been creating enormous adverse impact on the natural resources reserve. Waste generation and with an increase in population comes an increase in waste products that must be managed. A few countries used to ship tons of waste to China and a few other countries every year making it a dump yard, while India and China recently ban these activities and no longer import discarded plastics, yarn, cotton, ash, waste wool, slag from steelmaking, or paper etc. Traditional disposal methods fail miserably to adequately and properly handle the increasing load. Waste dumped into our oceans is polluting the planet and harming marine, animal, and human life. The good news is that in 2022 the United States started to crush some of the country’s mounting trash problems. India started crushing its legacy dump yards as directed by the National Green Tribunal (NGT) recently. These are being accomplished through the implementation of cutting-edge technology and through an unprecedented level of cooperation and coordination between recyclers, designers, packagers, manufacturers, businesses, municipalities, governments, and others. A new model of economy is being generated from the legacy dump yards in India in line with the concept of Circular Economy.

Waste management in many of the countries in Asia and the Pacific, Africa, a part of the USA, East Europe and some other parts in the globe went out of control due to various

factors. The sudden inability to ship much of the trash to the countries banning the import of wastes caused waste and recycling companies to scramble for highly effective waste management solutions. On the other hand, this gives a scope to raise to the occasion by strengthening the national policy instrument for reduction of waste generation, effective utilisation of generated wastes and building robust business models using wastes feedstock involving different technologies. New laws, along with massive cooperation and coordination between governments, businesses, and individuals, will also be required to successfully get on top of the situation. This activity needs the pentagonal cooperation among the actors- Government, Industries, Researchers, NGOs and the civil society.

We need to have the pathway to move forward for sustainable development. There are a number of initiatives, concepts, best practices, legislations which are the endeavour of coming out of the crisis and leave in less pollutes or no polluted globe. Following are a few of those.

- Sustainable development Goals 2030
- Circular Economy and 3Rs models,
- Zero waste models
- Pathways to waste prevention
- Pathways to Prioritising Waste
- Waste management business models
- Data and digitalisation to strengthen the waste management value chain
- Pathways to delivering societal change & adopting behavioural science
- Ensuring inclusion and representation
- Building national capacity
- Educate and involve the school children on waste management, Circular Economy & business models

International Society of Waste Management, Air and Water, (ISWMAW) established the IconSWM-CE platform in 2009 which involved more than 60 countries in last one decade. 14th Iconswm-CE & IPLA Global Forum 2024, which is being co-organized by, GITAM (Deemed to be) University, GITAM Technology Enabling Centre (G-TEC), International Society of Waste Management, Air and Water (ISWMAW), and International Partnership for Expanding Waste Management Services of Local Authorities (IPLA) will discuss various issues by the experts and delegates from nearly 50 countries in end November, 2025 using virtual platform and in-person presence. We must thank the GITAM University, for taking the responsibility and organising efficiently and successfully.

The objectives of the conference are,

1) To achieve chieve environmental sustainability by reducing the natural resource extraction.

2) To support support the Sustainable Development Goals.

3) Encourage researchers, industries, governments, NGOs and other stakeholders to reduce the generation of both solid and liquid wastes, reuse, treat and recycle those as is possible and if required, the inert or hazardous materials in scientific landfilling.

4) Establish the waste management practices to make zero landfill, utilisation of resources, employment generation through waste recycling and develop a circular economy in the industries and in the ULBs in city and village levels and in gated communities.

5) Enhance the research and development in the areas of waste management and circular economy.

6) Spreading the mission, "Catch Them Young: Zero Waste and Circular Economy in Campus" to encourage the school students to be involved in the waste management best practices and be knowledgeable on Circular Economy Concepts.

This event will allow around 650 papers and additional 30 presentations without papers which are included in the schedule. There will be nearly 582 presentations from 42 countries and UN organizations, namely UNCRD. This International Conference will deliberate on various issues related to innovation and implementation in sustainable waste management and circular economy including policy, design strategies & targets, solid & liquid waste segregation, collection, transportation, treatment technologies, life cycle analysis, climate change, circular economy, resource efficiency, wastewater treatment, faecal sludge management, research, business opportunities and many others.

This volume of the proceedings of the conference will be helpful for the researchers and other stakeholders. I hope that the event will make a fruitful discussion with the support and cooperation of all.

We expect to see you in the 15th IconSWM-CE & IPLA Global Forum 2025 at Graphic Era University, Dehradun, Uttarakhand, India in end November, 2025, and the School Children's Congress on Waste Management and Circular Economy. Dehradun, known as the 'Adobe of Drona', Dehradun, the capital of Uttarakhand State, lies at the foothills of Mussoorie, and is famous for its educational institutions, sulphur water springs, ancient temples and aesthetic fresh environment. The city is regarded as Dev Bhumi, also called by various names-Dron Nagri and Doon Valley etc.

28th November 2024
GITAM (Deemed to be) University,
Visakhapatnam, AP, India

Prof. Sadhan Kumar Ghosh
Chief Editor
on behalf of Editors & Editorial Board members
14th IconSWM-CE & IPLA Global Forum 2024

Announcement of the Journal Publication by ISWMAW

The Journal of Solid Waste Technology and Management (JSWTM)

Published by ***International Society of Waste Management, Air and Water (ISWMAW), India***

in Collaboration with: ***Widener University, Chester, USA*** **&** ***Consortium of Researchers in International Collaboration (CRIC), India***

Scope: JSWTM *publishes full length papers that provide significant contributions to the field of Solid and Liquid Waste Technology, Management & Recycling [Wastes of Plastics, Electrical & Electronic Equipment (e-waste), Municipal (MSW), Hazardous, Healthcare, Construction & Demolition, Biomass, Agricultural, ETP/STP Sludge etc.], Policy Instruments, Energy & Material Recovery, Recycled Products, Composites made using wastes, Waste Utilisation, Standardization, Business models & mathematical models related to Waste management, Circular Economy & 3Rs, Community development & participation in waste management & Circular Economy, Soil Pollution, Remediation, Sustainability, and SDG 12 related issues.*

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Subscriptions: Suresh Mondal (qmccal41@gmail.com)
Editor-in-Chief: Sadhan Kumar Ghosh (sadhankghosh.editor@gmail.com)
Editor: Ronald L. Mersky (rlmersky@widener.edu)

Postal Address:
Journal of Solid Waste Technology and Management,
ISWMAW, (International Society of Waste Management, Air and Water),
29/6, Jadunath Ukil Road, Kolkata 700041, India

Phone: +91 9830044464; +91 8240537668, +91 98310 50447 (WhatsApp too)
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About GITAM School of Business, GITAM (deemed to be) University

Founded in 1980, Gandhi Institute of Technology and Management (GITAM) was inspired by the ideals of Mahatma Gandhi. With 12 schools across four campuses, we dedicate ourselves to nurturing minds and spirits in a pursuit of educational enlightenment.

Established in 1988, GITAM School of Business (formerly known as GITAM Institute of Management) is a leading institution dedicated to quality management education. With a vision to become a global leader in higher education, GSB offers diverse graduate, post-graduate, and doctoral programs that align with industry requirements. The GSB situated in a lush green campus in Visakhapatnam, Hyderabad, Bengaluru have dedicated themselves to the cause of quality higher education in management. The three Business Schools have emerged at the forefront of professional management education and research, shaping the careers of young minds for more than three decades. The faculty comprises a judicious blend of youth and experience, academics and industry practitioners with a vast majority of them holding PhD qualifications. Some of them have had significant international experience. GITAM School of Business's teaching approach combines practicality, case studies, and modern technology, fostering a unique learning environment. The use of diverse methods of teaching, practical and situational delivery of courses, exposure to real-life managerial situations through Harvard Business case studies and state-of-the-art information and communication technology make it a truly unique learning experience.

The faculty of the GITAM School of Business involved in many projects such as circular economy in SMEs to combat climate change, tribal women empowerment through entrepreneurship, Sustaining, Competitive and Responsible Enterprise (SCORE) contributing to achieve Sustainable Development Goals and empowering women. These projects engaged SMEs in adopting circular economy practices, resulting in a 10% reduction in CO2 emissions for each SME involved. Industry-academia networks were created to drive these initiatives, promoting sustainability in small and medium enterprises.

TREI CSR project empowered tribal women by improving their general health, hygiene awareness, especially around menstrual health, and helped them become competent in selling and negotiating tribal produce. It also enhanced their decision-making abilities and operational success. The major funding sources are from the British Council, UK, Department of Science and Technology, British Council, UK, Aston University, UK, ICCR etc. and total funding amounted to Rs. 862 lakhs.

Circular Economy by School Children - the Next Generation

Prof. Sadhan Kumar Ghosh, www.sadhankghosh.com
Mentor, Mission, "Catch Them Young: Zero Waste and Circular Economy in Campus"

Introduction

I want to share my story of involving school children in tackling global challenges to build a sustainable society and ensure a livable environment for future generations.

Children are the global citizens of tomorrow, capable of influencing their families, and friends thereby shaping societal attitudes. During their formative years, when they are most receptive to new ideas, it is crucial to educate them about environmental stewardship, waste management, and the long-term impact of present actions, creating a cascading positive effect on society. To ensure sustainable development and achieve global goals, school and college students must be exposed to effective waste management practices, the principles of a circular economy, and resource efficiency.

I have conceptualised and designed the mission "***Catch Them Young: Zero Waste and Circular Economy in Campus***" to target school and college students to educate, encourage, and influence them to understand the need for waste management and Circular Economy for their benefits leading to evolving a sustainable environment. The mission will also make the children understand their roles and responsibilities towards the protection of the environment.

How the mission was conceptualised and evolved – some of my past activities

The International Conference on Sustainable Waste Management and Circular Economy (IconSWM-CE) is a flagship international event of ISWMAW, Initiated by me [Prof. Sadhan K Ghosh, www.sadhankghosh.com] and my team at Jadavpur University in 2009. The first conference was held in Kolkata at Netaji Indoor Stadium and Khudiram Anushilan Kedra which was attended by 700 delegates from seven countries, featuring more than 100 exhibition stalls. The success of the 1st IconSWM in 2009 laid a strong foundation for subsequent editions, leading to the 14th IconSWM-CE & IPLA Global Forum 2024, which will be held at GITAM Deemed to be University from November 28 to December 1, 2024. This event will be preceded by the 2nd School Children's Congress on Waste Management & Circular Economy on November 27, where 250 students and teachers from across India are expected to participate, showcasing their waste management and circular economy models, essays, and drawings. Today, IconSWM-CE has grown into one of the largest international conference platforms in India, with participation from 65 countries.

In 1982, following a sea expedition to Puri through the Bay of Bengal on a country boat, I established the **Institute of Ecological Exploration** in 1983 and led a tree census in Kolkata to support plantation planning. Under the Institute's banner, 250 young men and women from various clubs, schools, and colleges participated in significant plantation efforts. On **July 30, 1983**, we planted **2,000 saplings** at the Uttar Bhag Pumping Station in South 24 Parganas. From **August 13–15, 1983**, under the project titled *Plantation 1983*, we organized a three-day camp at Dabu and planted **13,000 saplings** along the Matla River near Canning to combat erosion. The saplings included **Shall, Shegun (Teak), Mahogany, Coconut, Turmeric, Eucalyptus, Subabul, Kubabul**, and **Babla Kanta (Acacia)**, eventually transforming the area into a thriving forest. Over time, the site became a popular destination for visitors, with

local authorities organizing picnics to promote its ecological importance. To mark this achievement and inspire continued community efforts, a **Silver Jubilee celebration** was held in 2008, motivating locals to further environmental conservation through tree planting and forest preservation.

In 2017, I conceptualised the Waste Management & Circular Economy model in the Housing Complex. I trained and encouraged the board of directors and other members in Diamond City South (DCS), near Karunamoyee, Kolkata 700041. I designed a simple composter for the housing complex. The DCS management implemented his idea at the end of 2017 when 572 flat owners, housekeeping staff, security staff, gardeners and 20 lady members of Clean & Green Group implemented the project of making compost from four composters and selling dry wastes for recycling which reduces the burden of nearly 90 tons of waste preventing to go to landfill site. This Housing Complex Waste Management Project in DCS was the first of its kind in Eastern India. In this IconSWM-CE platform of ISWMAW, there were several programs which were focused on school and college children apart from research and awareness programs for the seniors in Universities, Industries, Governments, and NGOs in different countries.

In 2017, I initiated a mission to engage school and college students in Waste Management and the Circular Economy. As part of this effort, nearly 200 students from 20 schools across Telangana participated in a debate competition on these topics at JNTU, Hyderabad. The event was held during the 7th IconSWM 2017 and was inaugurated at the Professor Jayashankar Telangana State Agricultural University (PJTSAU) in Hyderabad, which had been established as a separate entity from the central Acharya N. G. Ranga Agricultural University in 2014. The participating students were felicitated during the inaugural program, highlighting the importance of involving youth in sustainable practices and environmental stewardship.

Given its success, the **1st School Children's Congress on Waste Management and Circular Economy** was held on **3rd December 2022** during the **12th IconSWM-CE & IPLA GF 2022** at **Sree Venkateswara University, Tirupati, Andhra Pradesh**. This event brought together **150 students and teachers** from **25 selected schools** across Andhra Pradesh to showcase their innovative models in a competition. The mission, supported by funding from my personal income, the **International Society of Waste Management, Air and Water (ISWMAW)**, and other organizations, aims to promote awareness and practical solutions among young minds. Outstanding students, teachers, and schools were felicitated for their efforts. Following the overwhelming response, the **2nd School Children's Congress on Waste Management and Circular Economy** is scheduled to be held at **GITMA University on 27th November 2024**, continuing the momentum of inspiring youth to lead the way in sustainable practices.

About the Present Mission

This **Mission** includes the programme of generating and enhancing awareness levels among the students in schools and colleges to empower students, teachers and school management to responsibly manage waste and engage in sustainable waste management practices. The impact of waste disposal practices from the beginning of school education helps to bring out a bigger group of committed next-gen citizens who will grow within themselves a culture to protect the environment and develop a sustainable environment. This mission will also help

the students to develop their business acumen by bringing new products through the reuse and recycling of wastes as resources which have ample market in India.

Conceptualizing and initiation the Mission

In late 2019, Synod College, Shillong, Meghalaya, invited me to deliver a lecture at a seminar on Waste Management, supported by a central government project. However, the program was postponed twice in 2020 due to the COVID-19 pandemic. Despite the delays, Synod College maintained its enthusiasm and extended the invitation again in early 2021 for an online lecture. Following the lecture, the college requested my bank details to process the honorarium. Instead, I suggested using the funds to establish a Waste Management and Circular Economy facility at the college, focusing on waste segregation, composting, and recycling. The principal welcomed the idea, assembled a team of teachers, and requested my mentorship and guidance for the project. On December 1, 2021, the Waste Management, Segregation, and Circular Economy Facility was inaugurated at Synod College, involving nearly 4,500 students and teachers. Building on this success, Synod College collaborated with other institutions. On September 28 and 30, 2023, I delivered lectures and inaugurated similar facilities at four more institutions: Sharon Memorial School, Shillong; Nongra Presbyterial School; Mairang Presbyterial College, Mairang; and Nongstein Synod College, Nongstein. Over 3,500 students were trained, and waste management facilities were established for daily use. In Meghalaya, Synod College now serves as the coordinator of this mission, driving sustainability efforts across the state.

This project has a target of making one million people aware of waste management in Meghalaya and 50,000 students in schools and colleges by December 2025 will be directly involved in day-to-day Waste Management, Segregation and Circular Economy projects in colleges and schools in the hilly state of Meghalaya by December 2025. Meghalaya Project is a part of the Pan India mission of "Catch Them Young – Zero Waste & Circular Economy in Campus, [CTY: ZW&CEC]. In Meghalaya, nearly 10,000 teachers and students are working on the mission. A few new schools and colleges are expected to join in a few months.

***"Catch Them Young – Zero Waste & Circular Economy in Campus*, in West Bengal**

The Pan India mission of ***"Catch Them Young – – Zero Waste & Circular Economy in Campus***, [CTY: ZW&CEC] is a voluntary activity by the schools towards sustainable development, creating awareness among the students who are the next-gen citizens of our country and the teachers who will teach them and guide to take them to a higher echelon of awareness levels.

The target of this mission is to develop the facilities in schools and colleges involving students covering twenty million people in all the States and Union Territories in India by 2030 going in line with SDG 2030. Each of the schools will be supported in providing training to the teachers and students and establishing a waste management Facility. The manual and procedures for monitoring the system will be given. ISWMAW, respective schools and colleges and respective local municipality/Panchayat, may support mutual understanding. A major amount is being donated from my earnings. In this project, the earnings from the sale of dry waste and composting will be kept by respective schools and colleges. Training for interested students will also be provided on reuse and recycling and making business out the recycled products to develop young entrepreneurs. A new idea of

auctioning recycled products has been conceptualized and implemented in a few schools recently which has become very popular to the students, teachers, and guardians.

This mission is the first of its kind in the country. Following organisations and schools have expressed their primary interest to be involved in the project which may start soon. This is the first initiative where the school students are being trained, involved and practice Circular Economy concepts.

On March 30th, during a press conference at the Kolkata Press Club, I announced the launch of the "Catch Them Young – Zero Waste & Circular Economy in Campus" mission in West Bengal. This was readily accepted by eleven schools from Kolkata, South & North 24 Parganas, Nadia, and Howrah who were present in the press conference at Kolkata Press Club expressing their willingness to join and work in the mission. ISWMAW acknowledges the participation of the schools - Garia Harimati Devi Uchcha Balika Vidyalaya, Garia; Bishnupur High School (HS), Nadia; Baranagar Mohan Girls' High School (H.S.); Kamalapur Kamala Balika Vidyapith (HS), Dumdum, The Heritage School, East Kolkata Township; Santoshpur Rishi Aurobindo Balika Vidyapith; Green Park Siksha Sadan High School H.S., Raghunathpur Nafar Academy, Jadavpur High School, Jadavpur and Jadavpur Vidyapith. A target was set to involve 100,000 students and teachers in the schools in West Bengal by December 2025 and 10,000,000 people to be made aware of Waste Management & Circular Economy.

What is the present Status of the mission in West Bengal

In the press conference held on 30th January 2024 in Kolkata Press Club, I set an ambitious target to involve 100,000 students and teachers in the mission work, to reach nearly 2 million people in West Bengal to raise awareness about Waste Management (WM) and Circular Economy (CE) by December 2025. By July 9th, 2024, the mission had gained significant traction, with nearly 99,000 students and teachers engaged in its activities across 75 schools. As of August 23rd, 2024, the number of participants rose to 140,000, with 95 schools actively involved. The increasing interest from more schools has been very encouraging, reflecting the growing acceptance and popularity of the mission. It is very encouraging. The mission has become a movement in the schools with the potential to bring about a radical shift in the concepts among the school children and teachers on waste management, environmental protection and business models to support the sustainable development goals and Swachh Bharat Mission. As of 27th November 2024, 1,52,000 students and teachers have been working under the mission, "*Catch Them Young – Zero Waste & Circular Economy in Campus" from 152 schools in seven districts namely, Howrah, Hooghly, Jhargram, Nadia, South 24 Parganas, North 24 Parganas and Murshidabad in West Bengal and 10,000 students in Shillong, Mairang and Nongstein in the state of Meghalaya I will start the mission in the interested schools in Visakhapatnam and other parts of Andhra Pradesh. The changed target is by* December 2025 nearly 20,000,000 people to be made aware on Waste Management & Circular Economy.

As on 27th November 2024, 1,52,000 students and teachers have been working under the mission, "*Catch Them Young – Zero Waste & Circular Economy in Campus" from 152 schools in seven districts namely, Howrah, Hooghly, Jhargram, Nadia, South 24 Parganas, North 24 Parganas and Murshidabad in West Bengal and 10,000 students in Shillong, Mairang and Nongstein in the state of Meghalaya. The Institute of Engineering and Management, Kolkata has felicitated ten best performing schools in the mission in Campus waste management on 27TH September 2024.*

A few photos and medial clip are pasted on next page.,

Ten schools awarded for Zero Waste and Circular Economy Initiatives

n an effort to reduce environmental pollution and raise awareness about waste recycling among students, the International Society of Waste Management, Air and Water (ISWMAW) launched the "Catch Them Young: Zero Waste and Circular Economy on Campus" initiative. This mission, led by Dr. Sadhan Kumar Ghosh, aims to implement waste segregation, composting, and recycling practices in schools across West Bengal. The Initiative has already reached over 1,79,000 students and teachers from... PG 3

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KOLKATA

Morning India

Ten schools awarded for Zero Waste and Circular Economy Initiatives

3

MI News Service, Kolkata: In an effort to reduce environmental pollution and raise awareness about waste recycling among students, the International Society of Waste Management, Air and Water (ISWMAW) launched the "Catch Them Young: Zero Waste and Circular Economy on Campus" initiative. This mission, led by Dr. Sadhan Kumar Ghosh, aims to implement waste segregation, composting, and recycling practices in schools across West Bengal.

The Initiative has already reached over 1,79,000 students and teachers from 110 schools in districts like Howrah, Kolkata, and Murshidabad. Among these, ten schools were awarded for their outstanding work in waste recycling.

The project promotes waste management through composting, recycling, and business models for selling student-made recycled products. Notably, two schools in the Sundarbans were supported with funds to install micro-composting plants.

The mission started in the states of West Bengal and Meghalaya with great enthusiasm by the schools. The 1st Train the Trainers (T3) program was conducted on 5th March 2024, in the seminar room of The Heritage School. It was of great support lend by the management of

the Heritage Institute of Technology and the Heritage School in East Kolkata Township we got Fifty-five [55] Teachers from 11 schools and ISWMAW trainers to join the program.





2nd program was held in the Swami Vivekananda Institute of Science and Technology in South 24 Parganas and the Other three Train the Trainers programs were held at the Institute of Engineering and Management, Salt Lake, Kolkata. In total nearly 450 teachers from different schools were trained on the subject who in turn trained the students and other teachers.

Conclusion

I must express my gratitude to the HMs and TiCs in the schools for their positive approach to train and involve their students for the cause of waste management and environmental protection. Their efforts are very important for taking the activities in the mission forward. I must also thank the school students who were very much enthusiastic in wste segregation, making recycled products and earning from those recycled products made by them using waste materials. Some of the recycled products were really excellent. The mission "*Catch Them Young – Zero Waste & Circular Economy in Campus* has become very popular and growing faster in last 10 months with the involvement of 15,000 students and teachers in 16 schools and colleges on 30th January 2024 to 1,52,000 students and teachers as on 19th November 2024 in 154 schools and 3 colleges. I need support from individuals, government departments, industries and international organisations to take this movement forward. I appeal to you to please come forward and support the movement for the greater cause of the society. I hope that you will come forward to support and help. The mission activities have been in practice in the schools in Andhra Pradesh, Meghalaya, Telangana and West Bengal.

I.
Agricultural & Agro-Industrial Waste

Promising Aspects in Fabricating Aluminium Metal Matrix Composite Using Industrial Waste

Dilip Kumar Kar, Lopamudra Digal, Jayashree Mohanty*
Department of Chemistry, C.V. Raman Global University, India
**Corresponding Author:*

ABSTRACT: *The circular economy paradigm offers a transformative approach to industrial waste management by promoting the efficient recovery and sustainable utilization of resources. This study examines the potential of industrial waste streams, such as red mud, titania slag, fly ash, and many more as reinforcing materials for aluminium metal matrix composites (AMCs), which are known for their superior mechanical properties. These waste streams contain valuable secondary raw materials, including alumina, silica, titania, and carbon-based compounds, that can be effectively recovered and repurposed as reinforcing agents in AMCs. The use of these waste materials not only improves the mechanical, thermal, and corrosion properties of AMCs but also aligns with the principles of the circular economy by reducing waste and promoting resource recovery. This study discusses various methodologies for extracting and processing these industrial wastes, employing mechanical, thermal, and chemical treatments to enhance their compatibility with metal matrices. The mechanical properties of AMCs reinforced with these waste-derived materials, such as tensile strength, hardness, and wear resistance are critically evaluated. Additionally, challenges related to the variability in waste composition, the scalability of recovery processes, and economic feasibility are analyzed. The findings suggest that the incorporation of waste materials into AMCs not only contributes to material sustainability but also offers a pathway for future innovation in advanced engineering materials. This approach not only mitigates environmental impacts but also enhances the sustainability and cost-effectiveness of AMC production, aligning with the goals of a circular economy.*

Keywords*: Industrial waste, reinforcing materials, metal matrix composites.*

CRISPR-Cas9 mediated metabolic engineering of white rot fungus to produce an industry-value product from agriculture waste derived lignin

Deepa Khare*
Department of Biotechnology, Bennett University, Tech Zone II, Greater Noida, India
**Corresponding Author: deepa.khare@bennett.edu.in*

ABSTRACT: *Stubble burning contributes significantly to atmospheric pollution, leading to health hazards and environmental degradation. Thus, finding alternative uses for agricultural waste is imperative. Current studies rely on microbial species like white rot fungus, capable of utilizing lignin, a major component of agricultural waste, to produce industry-value products. However, the yield of the target product from these methods remains relatively low, partly due to the conversion to other compounds. To address this limitation, the study hypothesizes that inhibiting the conversion pathways could enhance the accumulation. The proposed research aims to employ metabolic engineering techniques to knockout genes responsible for this conversion using the CRISPR-Cas9 technique, thus increasing the target compound yield. By targeting specific enzymes involved in the conversion process, the study seeks to optimize production from agricultural waste. Ultimately, this research offers a sustainable solution to stubble burning while meeting the demand for valuable aromatic compounds. By leveraging biotechnological approaches and metabolic engineering, the study aims to enhance the bioconversion of agricultural waste into industrially significant products, thereby mitigating environmental concerns and promoting sustainable practices in agriculture and industry.*

Keywords*:*

Role of Extension in Agricultural Waste Management

Ishita Mishra*, V.L.V Kameswari

Dept. of Agricultural Communication, G.B Pant University of Agriculture and Technology, Uttarakhand, India

**Corresponding Author:*

ABSTRACT: *Agriculture, is often referred to as the bedrock of human sustenance and has profound influence on the global environmental landscape. Agriculture sector generates substantial quantities of waste, posing multifaceted challenges for both farmers and the society. According to FAO (2011), the spectrum of agricultural waste is as diverse as the sector itself. It encompasses manure and other by products from farms, the remnants of poultry house and slaughterhouses, harvest waste left behind in fields, the insidious runoff of fertilizers from cultivated lands, and the creeping infiltration of pesticides into water, air, and soils. Iqbal et al. (2020) categorized agricultural waste into three categories; viz: livestock waste, industrial processing waste, and post-harvest waste. Recent reports highlight regional variations in the scale of agricultural waste generated. Uttar Pradesh, topped the list of States generating, agricultural waste in the country in the year 2022. Cereal crops, contribute 70 percent of crop residue generated in the country. Amidst discussions of production and post-harvest losses, agricultural waste is often overlooked and its impact is underestimated. The evolution of agricultural extension services, initially centred around production systems. Later on, there was a shift towards market-led and farmer-led approaches. In the past, farmers in low-income countries dumped agricultural waste, or resorted to uncontrolled landfills. Progress and growing awareness have steered towards more sustainable agricultural waste management practices such as composting, energy generation from waste, and an earnest pursuit of zero waste practices. Improper disposal of Agricultural waste results in environmental pollution, climate change, economic losses, biodiversity erosion etc. Government has recognized the gravity of this issue and have launched various initiatives to tackle agricultural waste. Agricultural waste can be managed sustainably in several ways such as using it as soil mulch, turning it into cattle feed, harnessing its energy potential or even producing biochar. Despite the existence of numerous agricultural waste management models, there remains a conspicuous gap in the form of the limited engagement of extension agencies in promoting sustainable waste management practices. Extension organization, with their ability to reach the heart of farming communities, have a pivotal role to play in advancing agricultural waste management. They can foster awareness, provide guidance, and facilitate the adoption of sustainable practices for efficient resource utilization and environmental conservation. As the world confronts the formidable challenges of climate change and sustainability, adoption of sustainable waste management practices is no longer a choice but a necessity in which extension agencies have a significant role to play.*

Keywords*:*

Women's Empowerment through Agri-based Entrepreneurship: Strategies and Outcomes

Amrit Warshini*, Smita Singh, R.K. Doharey
Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P), India
**Corresponding Author: amritwarshini1312@gmail.com*

ABSTRACT: *This study explores the transformative potential of agri-based entrepreneurship in empowering women across various global contexts. The research synthesizes evidence from multiple studies, highlighting the significant role of women in agriculture and the persistent challenges they face, including limited access to resources, cultural barriers, and gender biases. The study examines effective strategies for promoting women's participation in agri-entrepreneurship, such as capacity building initiatives, access to finance, and leveraging digital technologies. Findings indicate that successful empowerment initiatives often adopt holistic approaches addressing multiple barriers simultaneously. The research also underscores the broader societal impacts of women's empowerment in agriculture, including improved food security, rural economic development, and shifts in gender norms. Future directions point towards emerging trends in agri-entrepreneurship, the potential of digital agriculture, and integration with sustainable farming practices. The study concludes with targeted recommendations for policymakers, development organizations, and researchers to further support and enhance women's empowerment in agriculture.*

Keywords*: Women's empowerment, agri-based entrepreneurship,rural development, food security, digital agriculture, sustainable farming, capacity building.*

Digital Technologies and Their Impact on Agricultural Entrepreneurship

Smita Singh*, Amrit Warshini, R.K. Doharey
Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P), India
**Corresponding Author: smitasingh006007@gmail.com*

ABSTRACT: *Digitalization is rapidly changing agricultural entrepreneurship in order to respond to the global challenges of food security adaptation to climate change, and rural development. This study looks into how such technologies are impacting farm management, markets, and diffusion of knowledge in agriculture. This paper carries out an literature review and analyzes case studies of how the Internet of Things, artificial intelligence, and big data analytics are changing agricultural practices. The research highlights successful digital agricultural ventures, thus showing practical applications and economic viability for these innovations. However, it shows big challenges in the form of a digital divide in rural areas, concerns about data privacy, and the requirement of technological literacy for farmers. The white paper outlined six priority recommendations for future development: (1) inclusive innovation for smallholder farmers, (2) comprehensive data governance frameworks, (3) digital skills training programs with focus, (4) integrating digital technologies in farming with sustainability-oriented approaches to farming, (5) public-private partnerships, and (6) investing in rural digital infrastructure. In contrast, research findings in this paper conclude that the effective use of digital technologies is also associated with addressing the aforementioned challenges through targeted interventions and adaptive policy frameworks. Long-term socioeconomic impacts of its use, exploration of emerging technologies, and the development methodologies for sustainability assessment of digital agricultural systems form relevant avenues of future research directions. This study is a new contribution to the digital agricultural entrepreneurship field of study, and findings will certainly provide valuable lessons to policymakers, entrepreneurs, and researchers interested in this area of specialization.*

Keywords*: Digital agriculture, Agricultural entrepreneurship, IoT in agriculture, Precision agriculture, Smart farming, Agricultural innovation, Sustainable agriculture.*

Agro-Industrial Waste Valorization: A Pathway to Circular Economy and Sustainable Resource Management

N. Sharma*, D. Massey, N. Dogra, S. Gautam

Department of Bio-Sciences and Technology, Maharishi Markandeshwar Engineering College, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala (Haryana), India

**Corresponding Author: nehamicrobiologist@gmail.com*

ABSTRACT: *Population growth and expansion of industries, globally is the major concern for improper management of agro-industrial waste. The food chain industry including agriculture and food processing industries generate large volumes of waste and if not managed properly, this waste poses high risks to the environment and public health. Concomitantly, the same can also be utilized to create new opportunities in the existing market. With technological advancements, a global shift is witnessed towards the principles of circular economy. Thus, agro-industrial wastes can be reused and recycled to produce biofuels, biochar, biofertilizers, antibiotics, enzymes, and animal feed. For instance, bio fuels such as bio ethanol and bio diesel derived from agricultural wastes are environmentally friendly, cuts down on greenhouse emissions and at the same time provide energy security. Brazil, the U.S. and India are extemporizing the need-based policy making for circularizing the linear economy trends as it holds the promise of meeting the growing energy demands in a sustainable manner. For these countries to be able to incentivize the benefits of sustainable waste management, there is therefore the need for strategic global partnerships, policy changes and need based investment in commercial research and development practices. Bio-economic agro-industrial waste management models are key to achieving the vision to considerably reduce waste generation, reuse wastes, recycle wastes and attaining the Sustainable Development Goals (SDGs). In this way, the loop of waste closing and its reuse or recycling provides the path to minimize the environmental impact of industries, thereby evolving newer techno-commercial avenues.*

Keywords*: Agro-industrial waste, Bio-char, Bio-fuel Circular economy, Sustainable Development Goals.*

Microbial Pigments: Perspectives into Agro-biotechnological Management of Floral Waste

N. Sharma*, N. Bansal, D. Sharma, S. Gautam

Department of Bio-Sciences and Technology, Maharishi Markandeshwar Engineering College, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, (Haryana), India

**Corresponding Author: nehamicrobiologist@gmail.com*

ABSTRACT: *Flowers give an aesthetic appeal to every jubilation and are therefore always used as value addition. They are also being used in making perfumes, food items, cosmetics, textiles, and other products. Enormous volumes of floral waste generated find their way into landfills and surface waters. This significantly leads to multi-faceted deterioration over a period of time. to environmental pollution. However, with growing awareness of appropriate technologies in sustainable development and scientific waste management, different methods have been tried aiming at the valorization of these floral wastes into various value-added products like pharmaceutically active components, compost, biofuels, biogas, bioethanol, organic acids, pigments, dyes, food products, incense sticks, handmade paper production, etc., which are discussed in this chapter. Different technologies involved and innovative approaches for floral waste management are discussed. Biotechnological interventions can lead to establishment of sustainable agri-preneurship models. One area where floral waste has enormous potential is formulation of microbe derived pigments. This review substantiates the unleashed prospects of floral waste through sustainable pathways.*

Keywords*: Anthropogenic, Floral waste, Microbial degradation, Microbial pigments, valorization.*

Effect of NPK Nutrients in Conjunction with Paddy Straw Management on Soil Properties and Crop Productivity in Transplanted Paddy

Dileep R[1,*], M.V Ravi[2], K Narayan Rao[1], S.N Bhat[3], S. Rao[4], Devanand Maski[5]

[1]Department of Soil Science and Agricultural Chemistry, UAS, Raichur, USA
[2]Agriculture Extension Education Unit, Koppal, UAS, Raichur, USA
[3]Department of Soil Science and Agricultural Chemistry, KVK, UAS, Raichur, USA
[4]Agronomy and Dean (Agri.), CoA, UAS, Raichur, USA
[5]Department of Renewable energy engineering, CoAE, UAS, Raichur, USA

**Corresponding Author: dileepr333@gmail.com*

ABSTRACT: *Effect of NPK nutrients in conjunction with paddy straw management on soil properties and crop productivity in transplanted paddy was conducted in this study. The RNR 15048 paddy variety was planted at instructional farm KVK, Gangavathi, Karnataka. The experiment was designed by Randomized complete block design with eight treatments and different straw management (Incorporation of straw with compost culture, burning of straw and removal of straw). In areas where harvesting has been mechanized all the straw remains in the field and is rapidly burned in situ, hence, losses of organic carbon, N, P and S. To overcome this, different paddy straw management options and its effect on soil available nutrients were studied. Soil properties such as soil pH, organic carbon, available N, P, K, bulk density, porosity, maximum water holding capacity and total microbial load were determined after burning of paddy straw, removal of straw and incorporation of straw with compost culture after growing season and compared with its properties before growing period. Control treatment presented less organic carbon and potassium than soil with paddy straw. Transplanted paddy cultivation in soil with paddy straw incorporation presented highest potassium, phosphorus and organic carbon compared with other. Potassium and phosphorus contents in paddy straw treatment were higher than that control treatment. In addition, lowest bulk density has been observed in soil with paddy straw applied. These results implied that straw incorporation with compost culture addition of fertilizers into the soil, improves the fertility and productivity of soils which is useful for plant growth.*

Keywords*: Straw management, Compost culture, Straw incorporation, Recommended dose of fertilizers.*

Current Trends in Local Vendors' Knowledge on Agro-Food Waste Utilization for Biogas Production

Joselyn B.C. Toomey[1,*], Rachan Karmakar[1], Suman Naithani[1], Nikhil Ranjan Behera[1], Adhirath Mandal[2]

[1]Department of Environmental Science, Graphic Era (Deemed to be University), Dehradun, India
[2]Department of Mechanical Engineering, Graphic Era (Deemed to be University), Dehradun, India

**Corresponding Author: toomeybcjoselyn@gmail.com*

ABSTRACT: *Efficient management strategies are needed to address the growing problem of agro-food waste while also helping to generate energy. Waste from agriculture and food production is a major global waste stream, playing a significant role in environmental problems and energy deficiencies. This research delves into the information provided by local vendors about using agro-food waste for biogas production, which can address waste management and energy requirements. Despite the growth in biogas technologies, significant gaps persist in understanding local vendors' perspectives and practices. The lack of extensive research in this are a signifies a need for this investigation. This gap is crucial as local vendors play a vital role in the supply chain of agro-food waste. It is crucial is to investigate local vendors' knowledge and practices in transforming agro-food waste in to biogas. This paper will employ a qualitative approach, gathering data through interviews and case studies from various local vendors. The expected results include a clearer understanding of local vendors' practices and potential barriers they face in biogas production. By gathering in sights directly from local vendors, the research will provide practical recommendations for enhancing biogas production at the community level and contributes to both theoretical knowledge and practical management strategies by suggesting ways to enhance local vendors' involvement in sustainable waste management practices.*

Keywords*: Agro-food waste, Biogas production, Waste management, Sustainable energy, Local vendor.*

AI Technologies Enhancing Water Accounting towards SMART Agriculture

Ashok G. Matani*

Dept. of Mechanical Engineering, Government College of Engineering, Jalgaon -[M.S.], India

**Corresponding Author: ashokgm333@rediffmail.com, dragmatani@gmail.com*

ABSTRACT: *Today, 25% of the global population lack access to clean water, 50% lack access to sanitation services and 30% lack access to hygiene facilities. Rivers, lakes, reservoirs, oceans, and groundwater are the primary sources of life, foundations of ecology, and keys to industrial activities and production systems. The conservation of water and sustainable water protection plays a key role in the sustainability of both human and ecological systems. A large number of satellite systems launched by nations including China, Canada, Europe, Japan, Korea, India, Russia, and the United States, which are providing different types of remote sensing images. Internet of Things-based Jana Jal Water on Wheels (WOW): A Public Finance Management System has been developed under Jal Jeevan Mission (JJM) to ensure transparency and modern fund management, A modern, public, online JJM— Integrated Management Information System has been implemented for planning, implementation, monitoring, and reporting of the district /village-level State/ National level progress on day-to-day basis. Internet of Things-based Jana Jal Water on Wheels (WOW) is a battery-operated three-wheeler with zero carbon emissions which is monitored by GPS, Internet of Things-based Jana Jal Water on Wheels (WOW) have been adopted in five priority states—Assam, Bihar, Tamil Nadu, Uttar Pradesh, and West Bengal to States and Union Territories since December 2020 on the recommendations of the Ministry of Water. Conclusions: Technology creates new ways of storing, abstracting and using water without addressing the underlying problem — more than the renewable fraction of water is being taken out. New technologies, sensors and satellite imagery are making this possible to improve water accounting. Government of India needs improved governance systems as well as provide an educated civil society for more sustainable and equitable management of water resources. By implementation of new techniques. Israel is now water secure and its groundwater level is increased. We need to implement the successful schemes adopted by other countries' successes specially Israel—it has turned a water crisis into an opportunity even though it receives one-fourth of the rainfall as compared to rainfall in India.*

Keywords*: IoT based Jana Jal Water on Wheels (WOW), innovative anti-counterfeiting technology-based solution, improved water harvesting and conservation initiatives, overcoming hydro-schizophrenia.*

From Farm Waste to Fertile Soil: The Role of Biochar in Sustainable Agriculture and Climate Resilience

Abhishek Kumar[1],[2,*], Tanushree Bhattacharya[2], Sanjai Parikh[1]

[1]Dept. of Land, Air, and Water Resources, University of California, Davis, California, USA
[2]Dept. of Civil and Environmental Engineering, Birla Institute of Technology, Ranchi, India

**Corresponding Author: abikumar@ucdavis.edu*

ABSTRACT: *The conversion of agricultural waste into valuable products is recognized as a practical and sustainable approach to address environmental challenges and improve soil health. In this study, the potential of biochar derived from agricultural residues, such as wheat and rice straw, was explored for heavy metal remediation and soil quality enhancement, even under simulated drought and flood conditions. Biochar, produced through the pyrolysis of organic biomass, is known for being carbon-rich and for its ability to improve soil fertility while adsorbing heavy metals, thus reducing their availability in soil. It was observed that biochar improved various soil properties, including water holding capacity, cation and anion exchange capacities, and nutrient content, while decreasing bulk density and the mobile and bioavailable fractions of heavy metals. These improvements were particularly beneficial for revitalizing soils subjected to extreme weather conditions. Additionally, the nutrient content of biochars was augmented in an eco-friendly manner by mixing them with dairy manure compost, and the nutrient-enriched biochars were analysed for their effectiveness in metal(loid) remediation and soil quality improvement. The biochars were found to support plant growth, including coriander (Coriandrum sativum) and Bengal gram (Cicer arietinum), by increasing nutrient availability and reducing metal toxicity, thereby contributing to sustainable agriculture. In summary, the study demonstrated the multi-faceted benefits of applying waste-derived biochar in soils, highlighting its role in promoting a circular economy, enhancing global food security, and mitigating soil pollution and the impacts of climate change.*

Urban Biowaste Potentials to Complement Crop Residue Management - Case Study Germany

Burkhard Wilske*, Karl-Friedrich Cyffka, Jasmin Kalcher, Friederike Naegeli de Torres, Romy Brödner

DBFZ Deutsches Biomasseforschungszentrum (German Biomass Research Center) Bioenergy Sytems Department, Torgauer Str. 116, 04347 Leipzig, Germany

**Corresponding Author: burkhard.wilske@dbfz.de*

ABSTRACT: *Use of agricultural byproducts and residues is regulated through the Circular Economy Act, bylaws and intense competition of resource use due to a growing German Bioeconomy. Crop residue management (CRM) must comply to maintain the soil humus balance, slurries from declining livestock feed biogas fermenters and energy generation, and bulk residues such as cereal straw find increasingly use for bio-based products. A policy target of 30% organic agriculture in 2030 coupled with increasing demands in bioenergy and bio-based products compels to reallocate resource use of secondary biomasses to achieve NDCs and SDGs. The Biomass Monitor, as part of the DBFZ Resource Database, covers details of 77 aggregated biomasses which represent the national resource base of secondary biomass (divided into 5 sectors: Agricultural by-products {22}, Forestry byproducts {7}, Industrial residues{23}, Municipal waste and sewage sludge {14}, and Residues from other Areas {11}). Even before the recent forest dieback, forestry secondary biomass was not available to maintain agricultural productivity. Further, the sector 'Industry' has been shaped by circular economy to re-use its entire output of secondary biomass. Technical Secondary Biomass Potential of Agriculture and Municipalities was 27.2 and 34.0 Mill t Dry Mass in 2020, respectively, of which 51.5% and 78.6% were used. The agricultural potential unused and still mobilizable (48.5%) underlies many competing uses in future energy generation and material production. Although partly still impeded by logistical, economic and technical challenges, the mobilizable potential of municipal/urban biowaste (21.4% incl. household and food waste, green waste from urban greenery and else) remains the most promising source of carbon and nutrients to enhance soil carbon stocks and strengthen climate resilience of cultivated soils, as stipulated by recent initiatives of the European Commission..*

Keywords*: Bio-resources competition, Circular Economy, Sustainable Development.*

New Approach for Making Agriculture Waste as Zero Waste

Prathipati Aditya*, Ganisetti Anitha, Subbarayudu Gundra

MS Swaminathan School of Agriculture, Centurion University, India

**Corresponding Author: prathipatiaditya@myyahoo.com*

ABSTRACT: *Waste plays a key factorial role in today's world's sustainable livelihood perhaps it's not in a positive manner but in the mode of threat to the world's society. In this situation, the front-line solution is to reuse the waste but not in its original form to convert it into recycled and convertible handling. The waste consists of many aspects in that agriculture waste is mostly recycled and made into a perfect byproduct or any biodigestivity manure from livestock or Plant material waste. Agriculture waste can be converted into a zero waste management approach because of its basic nature of degradability but the only matter here is time. In this new approach, the main task is using the waste at the right time which could make the zero-efficient management concept (ZEMC)generate an additional income from already harvested crops that are not used properly in current agricultural and manure aspects. Agricultural waste management is a typical concept for upgrading farmers' income and also allowing the soil to absorb in a very easy manner. In this zero waste can be generated for the self-utilization procedure. The only point to get into the highlight is toxicity which is one of the make ingredent which is introduced into the to plant, animals and human through many direct and indirect channels. This discusses the new approach related to agricultural waste to zero waste management.*

Keywords*: sustainable livelihood, biodigestivity, Zero-Efficient Management Concept (ZEMC).*

Crafting an Antimicrobial Green Emulsion Concentrate for Crop Care

T. P. Karunya, K. Jagajjanani Rao*
Department of Biotechnology, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, India
**Corresponding Author: drjagajjananirao@veltech.edu.in*

ABSTRACT: *Industrialized agriculture tends to use long term application of synthetic pesticides for high yield. However, current practices mostly rely on chemical pesticides which are costly as well as environmentally harmful. Naturally available plant protectants such as essential oils (EOs) which show antimicrobial properties, have low toxicity and are environment friendly, could be used as alternatives for chemical pesticides. The primary goal of this study is to reduce the indiscriminate use of conventional pesticides in accordance with safe environmental applications by utilizing nanotechnology to create nano pesticides. Three essential oils [Eucalyptus oil, Clove oil, Neem oil] were selected and blended at varying proportions to form a stable nanoemulsions concentrate. Nine different trials were obtained by mixing combination of essential oils with different emulsifiers and solvent. Trial 5(3,000,000 ppm) and Trail 7(2,000,000 ppm) were identified as stable emulsifiable concentrate by their difference in refractive index. This stable T5 and T7 were further tested by diluting into three different concentration (2000 ppm, 1000 ppm, 500 ppm). This emulsion concentrate was tested against the bacterium Escherichia coli and two different disease-causing fungal species Aspergillus sp, Fusarium sp. for antibacterial and antifungal activities respectively and the results of T5(I) and T7(I) with 2000ppm have shown higher efficacy in antimicrobial activities. Spectral analysis via Fourier Transform Infrared spectroscopy and toxicity studies were conducted to assess the effectiveness and biocompatibility of essential oils as pesticides.*

Keywords*: Essential oils, Emulsion Concentrate, crop care, Anti-microbial studies, Antifungal studies, FTIR, Toxicity studies.*

Assessment of Heavy Metal contamination in agricultural soils and implications for soil remediation

Venkatappala Naidu Karanam[1], Gopamma Daka[2], Namuduri Srinivas[2,*]
[1]Department of Biosciences, RGUKT, Andhra Pradesh, India
[2]GITAM School of Science, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: snamudur@gitam.edu*

ABSTRACT: *The ecosystem originates and ends with the soil, a vital link between human life and the environment. However, the harm that heavy metals (HMs) inflict on the environment has outpaced nature's capacity to cleanse itself, endangering ecosystems and human health. Rapid socioeconomic growth and human activity enhance this contamination, which lowers crop yields, degrades ecological quality, and poses health hazards through food chains. This study aims to identify the heavy metals present in the agricultural soils of the Andhra Pradesh, India, districts of Krishna and Eluru. Determining HM concentrations in soils and crops, assessing contamination using pollution indices, and studying bioaccumulation and translocation factors in crops. To evaluate the data, the study used statistical approaches like PCA and environmental indices using ICP MS. The trends of heavy metal uptake in crops varied; for example, amaranthus and black gram revealed diverse accumulations of metals like Zn, Cu, Mn, and Cr. The necessity for focused remediation techniques was highlighted by the soil indices, which showed varied levels of contamination with notable enrichment and pollution, particularly for Mn and Cr, across different seasons. While the roots and shoots of Jonnapadu do not exhibit bioaccumulation or bio concentration of metals when compared to other areas. In the one study area, Amaranthus shows no metal deposition other than zinc. Loading of heavy metals based on PCA for the four regularly monitored agricultural sites. When the PCA was performed on the data of six HM concentrations, two PCs were found (eigenvalues > 1 for Ni and Cr; the remaining metal eigenvalues are below 1). The findings will help develop strategies to reduce the possible future risks associated with heavy metals in soils in long-term. By detecting and addressing individual contaminants, farmers can take focused actions to reduce their negative effects on crops and guarantee food safety.*

Keywords*: Heavy metals, Pollution indices, Bioaccumulation factor, Translocation factor, Principle component analysis.*

Supporting circular economy through crop-livestock increased integration in North Western Vietnam

Melanie blanchard[1,*] , Thanh Huyen Le thi[2], Hàn Anh Tuấn[2], Nguyen Thanh Trung[2], Dong Na[3], Pascal Lienhard[4]

[1]Selmet, CIRAD, Univ Montpellier, Montpellier, France
[2]National Institute of Animal Science (NIAS), Hanoi, Vietnam
[3]Agroecology and Safe Food Systems Transition (ASSET) project in South East Asia, Dien Bien Phu, Vietnam.
[4]Aida, CIRAD, Univ Montpellier, Hanoi, Vietnam

**Corresponding Author: melanie.blanchard@cirad.fr*

ABSTRACT:*Crop-livestock integration is a major pathway towards a greener and more circular economy. This is particularly true in northwestern Vietnam mountainous areas, where livestock, notably large ruminants, and perennial crops are both seen as major pillars of local agricultural development strategies. Livestock development is currently under pressure in a context of animal roaming restrictions, and scarcity of land for animal feed production or collection. The rapid expansion of perennial crops raises also the issue of farmers increased dependency to external inputs, notably fertilizers.Silage feed can be made from a diversity of forage material, including agricultural by-products with little or no current use such as cassava stems and leaves, and stored for periods when feeds are less available or farmers busy with other activities. Compost is decomposed organic matter from various sources including animal feces and crops residues. As compared to untreated manure, compost helps removing bad smell, killing weeds' seeds and some disease germs, and reducing the weight of the final organic product making it easier for farmers to transport and apply in their fields.In Dien Bien Province, it is estimated that using 45% of cassava by-products into silage could cover up to 10% of large ruminants feed need during the four-month winter season. The increased collection and transformation of 40% of animal manure into quality compost could help recycling annually 11,000 tones of Nitrogen for crop production.Silage and compost technologies are good examples of enhanced crop-livestock integration, and improved circular economy in agriculture. But they are labor, technically and financially intensive so that the uptake of such technologies following sole training is usually low without external supports.* for *initial investments such as choppers, double -layer silage bags, and Efficient Microorganisms (EM).*

Keywords*:*

Advancements in Biodegradable Pots: The Role of Natural Rubber And Biomaterials In Sustainable Agriculture

Manish Dhawan*, Varalakshmi Kedati, Chaitanya Deepti, Peddi Pullaiah and M.Abhinay

Lovely Professional University, Phagwara, Punjab, India

**Corresponding Author: manish.14630@lpu.co.in*

ABSTRACT: *The paper presents comprehensive review of biodegradable pots using natural rubber, Plastic waste has become one of the most pressing environmental challenges from decades. These plastics contribute to soil degradation, reduced fertility, and harm to beneficial organisms through bioaccumulation and bio magnification. This review paper examines recent advancements in biodegradable pots, including the biomaterials and natural rubber used, their technically (physical -mechanical) properties, and environmental degradability in water and soil, and their applications in various agricultural sectors. By exploring various aspects, this review aims to highlight the potential & capability of biodegradable pots as a sustainable solution to meet agricultural productivity goals while addressing environmental concerns.*

Keywords*: Biomaterials, Biodegradable pots, Natural Rubber, CNT, Composite.*

Enhancing Soil Fertility with Organic Amendments – A Sustainable Agricultural Practice

Hemalatha Vegi*, V D N Kumar Abbaraju

Department of Environmental Sciences, GSS, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: hvegi@gitam.in*

ABSTRACT: *Intensive cultivation and excessive use of chemical fertilizers can deplete soil organic matter, harm the environment. While fertilizers are crucial for high yields, especially in nutrient-poor soils, rising costs and limited resources make organic amendments like compost and manure a more economical and eco-friendlier alternative. Unlike plant residue and manure, compost releases nutrients slowly, providing long-lasting effects that enhance soil fertility. The aim of this research to explore the physical and chemical properties of different compost made from different raw materials. Composts prepared from different organic wastes differ in their quality and stability, which further depends upon the composition of raw material used for the compost production. Compost quality is closely related to its stability and maturity. The wide variety of chemical and biological variations that occur during composting. This study compared commercial, kitchen, and dustbin composts, revealing distinct differences in their chemical and nutrient profiles. The pH of Kitchen (7.64) and dustbin (7.65) composts were found to be more alkaline than market (7.02) compost. Kitchen compost (0.17 dS m-1) exhibited the lowest electrical conductivity and the highest C/N ratio (16.82), suggesting it decomposes more slowly but could provide long-lasting benefits to soil structure. Commercial compost, with its higher nitrogen (1.28%), phosphorus (0.57%), and potassium (0.7%) content, is the most nutrient-rich, making it the most effective for immediate nutrient supply. However, kitchen compost, with its high copper (1750 ppm) and iron (445 ppm) content, and dustbin compost, with higher levels of lead (118 ppm) and cadmium (4.2 ppm), present both benefits and potential risks. Overall, while commercial compost appears to be the most balanced option for nutrient supply and soil improvement, kitchen and dustbin composts offer unique advantages that could be beneficial depending on specific agricultural needs. Careful consideration of these properties is essential for optimizing compost use in sustainable agriculture.*

Keywords*: Compost, sustainable agriculture, C/N ratio, Kitchen compost, dustbin compost, commercial market compost.*

Opportunities and Challenges of Agripreneurship in Rural Areas-A Case Study in Visakhapatnam, Vizianagaram, And Srikakulam Districts

Sivanagesh Penta

India

**Corresponding Author: spenta1@gitam.in*

ABSTRACT: *Agripreneurship plays a critical role in rural development, particularly in regions where agriculture is the primary source of livelihood. This study investigates the opportunities and challenges faced by agripreneurs in the rural areas of Visakhapatnam district. A stratified random sampling method was employed to ensure a representative sample of agripreneurs from diverse geographic and socio-economic backgrounds. Data was collected using structured questionnaires and personal interviews, focusing on key aspects such as the socio-economic characteristics of the founders, the influence of geographic and social factors, and the specific marketing, financial, and production-related challenges faced by agripreneurs. The data analysis combines quantitative and qualitative approaches: statistical methods such as frequency analysis, correlation, and regression were used to analyze survey responses, while qualitative thematic analysis was employed to evaluate the interviews and open-ended responses. In addition, the study examines the growth of agribusiness in agriculture. It provides recommendations to address the identified challenges, aiming to enhance the sustainability and viability of agri-businesses in rural Visakhapatnam, Vizianagaram, And Srikakulam Districts. The findings offer valuable insights for policymakers and agripreneurs seeking to improve the economic and social landscape of rural agriculture.*

Keywords*: Agripreneurship, Rural Development, Socio-economic Factors, Sampling Methods, Questionnaire, Data Analysis, Visakhapatnam, Agricultural Challenges.*

Impact of Waste Circular Economy in achieving Sustainable Development Goals: A State-Level Analysis of Agricultural Waste Management in India

Chowdhury S R[1], Ghosh S K[2], Modak Nipu[3]

1Bureau of Applied Economics and Statistics, Department of Planning and Statistics, Govt. of West Bengal and Jadavpur University, Kolkata, India
[2]Ex-Dean, Faculty of Engineering and Technology and Professor and Formerly Head of Mechanical Engineering Department, Jadavpur University, Kolkata, India
[3]Mechanical Engineering Department, Jadavpur University, Kolkata, India

**Corresponding Author: sona_rc@yahoo.co.in*

ABSTRACT: *Circular economy (CE) practices in agricultural waste management system would optimally utilize resources, minimize waste, enhance productivity, and foster environmental, economic, and social sustainability and thus offer a transformative approach to advancing Sustainable Development Goals (SDGs) across India. While lots of literature exists on CE practices on Agricultural waste, limited studies explore state-specific comparison among India's key agricultural states in their progress in applying CE principles in managing Agricultural waste to achieve the targets of Sustainable Development Goals (SDGs). This study assesses the progress of key agricultural states of India—Maharashtra, Punjab, West Bengal, Gujarat, Uttar Pradesh, Tamil Nadu, Karnataka, Rajasthan, Andhra Pradesh, Haryana, Madhya Pradesh, Bihar, Kerala, and Odisha—in implementing CE strategies on Agricultural waste, focusing on biogas production, composting, and other value extraction techniques from agricultural waste resulting in reduction of volume of agricultural waste, avoiding substantial amount of Green House Gas (GHG) emission and scope of revenue and employment generation. By analyzing secondary data and reviewing state policies, this research evaluates the effectiveness of CE initiatives by using agricultural waste in production of clean energy and compost. This initiative is conserving natural resources, and supporting several SDGs like SDG7 (clean energy), SDG12 (responsible consumption), SDG8 (decent work), SDG13 (climate action). Results reveal significant state level disparities in CE adoption due to variations in policy support, technological interventions, and infrastructural facilities. The findings provide valuable insights for policymakers to enhance effective CE practices on Agricultural waste across key agricultural states of India, support economic resilience, and help India move towards achieving Sustainable Development Goals in due time.*

Keywords*: Circular Economy (CE), Agricultural waste management, Sustainable Development Goals, GHG emission, Composting, Clean Energy.*

ReLEAF: Bio-Wastes as sources for production of circular controlled-release fertilising products to improve soil quality

Rubén Rodríguez-Alegre*, Sergi Durán-Videra, Laura Pérez Megías, Carlos Andecochea Saiz, Xialei You

Leitat Technological Center, Circular Economy & Decarbonization department, C/ de La Innovació Terrassa, Barcelona, Spain

**Corresponding Author: rrodriguez@leitat.org*

ABSTRACT: *Fertilisers are widely used by the food industry and are essential to meet the global demand for food. Most of these fertilisers come from non-renewable sources, mainly fossil fuels and mineral deposits. Within a current framework of non-renewable resources depletion and rising geopolitical tensions, it is crucial to reduce the dependence on imported resources. The ReLEAF project aims to address these challenges by producing sustainable Bio-Based Fertilisers (BBFs) to compete in the global market. This will be done by turning bio-wastes into valuable products through: improving new technologies for producing fertiliser ingredients; using safe coatings for Controlled-Release Fertilisers production to prevent microplastics and soil harm; reducing nutrient losses and fertilisers use through precise fertilisation techniques; ensuring the effectiveness of BBFs through agricultural testing; reducing reliance on imports by building local, circular, and cost-effective supply chains; and involving key players to promote industrial adoption and social acceptance. Several wastes such as sewage sludge, fish processing wastewater and sludge, mixed food waste, and agricultural residues will be assessed for producing nutrients, biostimulants, and biopolymers to create controlled-release fertilisers and functionalised horticultural products that allow precise fertilisation. ReLEAF will produce BBF and functionalised horticulture elements prototypes on a pre-industrial scale and test them in open fields with different climates and soil types in Spain, France, and Poland to ensure their safety and effectiveness. ReLEAF products will lead to market by developing new local supply chains and circular business models that involve all stakeholders, including bio-waste providers, the fertiliser industry, farmers, and consumers.*

Decarbonizing The Built Environment: Mitigating Climate Change Through Agricultural Waste Management

Rupa Jawal*, Sadhana Vuddemarry

School of Architecture, GITAM University, India

**Corresponding: rjawal@gitam.edu:*

ABSTRACT: *Annually a substantial amount of agricultural waste is generated to dispense for the growing global population. Inappropriate methods of agricultural waste management are a source of great concern causing land, water and air pollution. Crop residues and agricultural wastes, mainly composed of cellulose, lignin, and hemicellulose, most of which remain an underutilized resource. A large fraction of this waste is disposed either through burning or ends up in landfills. Efficient management of this agricultural wastes can assure sustainability, food security, and public health. One potential roadmap to decarbonize and decrease the demand for conventional building materials can be by using agricultural waste in stabilized mud blocks to reduce carbon emissions. Stabilized mud blocks integrating common agricultural waste products like vermiculite, sugarcane bagasse, rice husk, and coconut husk are studied. Therefore, this research focused on evaluating the thermal performance, durability, and economic feasibility of these building blocks as a walling material in India. The results from this study could present new opportunities for innovative building practices for a more sustainable construction industry and circular economy by valorizing agricultural wastes into a resource. Ultimately, the present study aspires to contribute to the efforts toward a sustainable development goal by demonstrating that agricultural waste can be an integral part in the makeup of eco-friendly construction material which helps on mitigating the climate change.*

Keywords*: Decarbonization, circular economy, Agricultural waste, compressive strength, durability, workability, Eco-friendly Construction, Agricultural Residues*

Optimized Crop Selection and Price Forecasting Using Enhanced ML Frameworks for Boosting Farm Productivity

C. A. Rishikeshan*, Biyyapu Sri Vardhan Reddy, Jayanthi R, Anjena V

[1]School of Computer Science and Engineering,Vellore Institute of Technology (VIT), Chennai,Tamil Nadu, India

**Corresponding Author: rishikeshan.ca@vit.ac.in*

ABSTRACT: *Agriculture is a vital sector in India, providing employment to a significant proportion of the population and contributing significantly to the country's economy, any efforts to improve the productivity and profitability of farming operations are highly valuable. One way to achieve this is through the development of a crop recommender system that assists farmers in deciding which crops to produce based on various input characteristics such as soil mineral content and rainfall. The proposed crop recommender system is intended to facilitate farmers and agricultural enterprises efficiently to improve their yields and profits. The system takes into account essential factors, such as soil mineral content and rainfall quantity, to recommend suitable crops for farming in a given location. The input characteristics considered by the system are crucial for crop growth, and any other necessary traits are included. To develop the crop recommender system, several machine-learning techniques can be employed for multiclass classification. Algorithms such as Support Vector Machines (SVM), Random Forest, and ensemble methods like bagging and boosting can be used. Neural networks can also be utilized to optimize the system's performance, including predicting future rainfall by analyzing time-series data. The system can help farmers make informed decisions regarding which crops to plant based on the local environmental conditions. The implementation of a crop recommender system, which takes into account crucial input characteristics like soil mineral content and rainfall quantity, holds great potential to yield substantial benefits for both farmers and the Indian agricultural industry. Leveraging advanced machine learning techniques such as SVM, Random Forest, and neural networks enables the system to offer precise and practical recommendations, leading to heightened productivity and enhanced profitability for farmers..*

Keywords*: Agriculture, Crop Selection, SVM, Random Forest, Rainfall.*

Investigating local vendors' knowledge and barriers to Agro-food waste utilization for Biogas Production in Monrovia, Liberia

Joselyn B.C. Toomey*, Suman Naithani, Rachan Karmakar, Nikhil Ranjan Behera, Adhirath Mandal

Graphic Era (Deemed to be University), Dehradun, India

**Corresponding Author: toomeybcjoselyn@gmail.com*

ABSTRACT: *Efficient management strategies are needed to address the growing problem of agro-food waste while also helping to generate energy. Waste from agriculture and food production is a major global waste stream, playing a significant role in environmental problems and energy deficiencies. This study evaluated the knowledge, practices, and barriers faced by local vendors in Monrovia, Liberia, regarding agro-food waste utilization for biogas production. Recognizing the significance of waste management for sustainable energy generation and enhance knowledge in developing nations such as Liberia, the study fills a gap in understanding the role of local stakeholders in waste-based energy production. A descriptive and exploratory research design was applied, utilizing surveys and interviews with 100 local stakeholders, including small-scale farmers, retail vendors, and food processors from six markets in Monrovia. The findings reveal that while a significant majority of vendors show strong interest in adopting biogas technology, 82% lack formal training, and 45% report low technical knowledge, limiting effective implementation. Structural and institutional barriers, such as limited government support and accessibility to technology, further hinder adoption. This study underscores the need for capacity-building programs, government subsidies, and enhanced accessibility to biogas infrastructure, aiming to foster an integrated approach to waste management. Future research should explore scalable biogas systems adapted to local conditions, contributing to the circular economy and environmental sustainability in Liberia.*

Keywords*: Agro-food waste, Biogas production, Small Scale Farmers, Retail Vendors, Sustainable energy solutions.*

II.
Bio Medical Waste Management

Biomedical Waste Management- An Integral Part of Healthcare Operations

S.S. Rajasekar[1,*], Roja Rani[2]

[1]Dept. of Anatomy, GITAM institute of medical Sciences and Research, India
[2]Department of Anatomy, Government Medical College (RIMS), Srikakulam, Andhra Pradesh, India
**Corresponding Author: ssrajasekar7@gmail.com*

ABSTRACT: *Introduction: Biomedical waste management is a critical aspect of healthcare that ensures the safe disposal of waste generated during medical activities. Proper management of biomedical waste is essential to prevent the spread of infections, protect the environment, and ensure the safety of healthcare personnel and the public. Healthcare facilities generate various types of biomedical waste, including sharps, infectious waste, chemical waste, and pharmaceutical waste, each requiring specific handling and disposal methods.*
Discussion: Healthcare personnel play a pivotal role in the effective management of biomedical waste. Their awareness, training, and adherence to established protocols are crucial in minimizing the risks associated with waste handling. The segregation of waste at the source, use of personal protective equipment (PPE), and proper disposal methods using innovative techniques are some of the key practices that healthcare workers must follow to ensure safety and compliance with regulatory standards. We have developed a method of e waste management which was later used for constructing a road in our previous institute.
Despite the existence of guidelines and regulations, challenges such as inadequate training, lack of resources, and insufficient monitoring can lead to improper waste management practices. This not only endangers the health of healthcare workers but also poses significant risks to patients, waste handlers, and the community. Therefore, continuous education, Innovative thinking and ideas in waste management, regular audits, and the implementation of best practices are essential to improving biomedical waste management in healthcare settings.
Conclusion: Biomedical waste management is an integral part of healthcare operations that demands the active participation of healthcare personnel. Ensuring proper waste management practices not only protects the health of individuals but also contributes to the overall public health and environmental sustainability. The commitment of healthcare personnel to adhering to safe practices is vital in achieving effective biomedical waste management.

Keywords*: Biomedical waste, E waste, healthcare operations.*

Waste Management in Medical Laboratories

Pawan Kumar*

Institute of Genomics and Integrative Biology, Delhi, India
**Corresponding Author: pawangaba@gmail.com*

ABSTRACT: *Medical laboratories are critical components of the healthcare system, but their operations generate various types of waste that pose risks to health and the environment. This research article explores the types of waste generated by medical laboratories, the challenges involved in managing these wastes, and the best practices and strategies for effective waste management. Emphasis is placed on ensuring safety, regulatory compliance, environmental sustainability, and reducing risks to laboratory staff and patients. The study highlights the importance of waste segregation, safe disposal, recycling, and continuous education for laboratory staff.*

Keywords*: Waste management, medical laboratories, hazardous waste, biohazard, segregation, environmental sustainability, regulatory compliance.*

Environmental Impact and Technological Innovations of Biomedical Waste Management

N.T. Mary Rosana*, Bavithra. B, K.L. Vincent Joseph, P.G. Priyadarshini
Department of Chemical Engineering, Rajalakshmi Engineering College (Autonomous), Chennai, India
**Corresponding Author: maryrosana.nt@rajalakshmi.edu.in*

ABSTRACT: *Biomedical waste management focuses on the safe and complete elimination of hazardous waste generated in healthcare settings. It aims to remove pathogenic organisms from waste that could harm the environment. Unlike regular garbage, biomedical waste is dangerous due to its composition, origin, and chemical content, requiring specific safety measures for handling, treatment, and disposal. Proper waste management is essential to reduce pandemic-related risks and promote sustainable environmental practices. Its importance is highlighted by its impact on ecosystems and the contaminants produced by healthcare activities. Improving education and training in biomedical waste management is crucial to achieving better outcomes in environmentally friendly healthcare. Responsible waste disposal is essential to protect the environment. This work outlines various methods for managing biomedical waste, including segregation, packaging, and transportation, emphasizing the critical need for proper disposal in addressing challenges in biomedical waste management. To protect the environment from biomedical hazards, the 3-R method helps to promote sustainability by minimizing waste production and conserving resources. Innovative waste treatment technologies like plasma gasification, microwave sterilization, and waste-to-energy conversion promise to reduce the environmental footprint of biomedical waste disposal, moving away from traditional incineration and landfilling methods. Alongside these technological advances, the increased use of biodegradable materials and recycling within the medical industry will contribute to a more sustainable and circular approach to waste management.*

Keywords*: Biomedical waste, Segregation, Package, Transportation, Proper waste management, Plasma gasification, microwave sterilization, waste-to-energy conversion.*

Zero-Transmission Endoscopy: Innovations in Medical Waste Management for Infection Control

H. Prem Kumar*, R. Prabusankar
GRG School of Management Studies, PSGR Krishnammal College for Women (Autonomous), (Affiliated to Bharathiar University), Peelamedu, Coimbatore, India
**Corresponding Author: haiitsmepk@gmail.com*

ABSTRACT: *The increasing use of single-use medical devices in endoscopic procedures has raised concerns about waste management and environmental sustainability. This research focuses on Zero-Transmission Endoscopy, exploring innovations in medical waste management that ensure infection control without compromising ecological safety. Traditional disposal methods for single-use endoscopic instruments, especially those contaminated with blood and bodily fluids, pose significant risks for cross-contamination and disease transmission. Through a review of current practices and emerging technologies, this study evaluates eco-friendly disposal methods, such as advanced sterilization, material recovery, and biodegradable alternatives, aiming to minimize environmental impact while maintaining stringent infection control standards. Additionally, it assesses closed-loop systems in healthcare, where waste from endoscopic procedures can be converted into secondary raw materials or up cycled. By integrating circular economy principles and innovative waste treatment technologies, this research proposes a sustainable model for managing medical waste in endoscopy that prioritizes both public health and environmental protection, thereby contributing to a zero-transmission and eco-friendly healthcare system.*

Keywords*: Zero-Transmission, Healthcare, Waste Management, Sustainability.*

Artificial Intelligence in Biomedical Waste Management – A Case Study of India during the COVID-19 Pandemic

Miyyapuram Shivani*
India
**Corresponding Author: miyyapuramshivani@gmail.com*

ABSTRACT: *The mismanagement of biomedical waste poses significant environmental and public health risks, a challenge that has been exacerbated during the COVID-19 pandemic in India. The surge in medical waste generated from hospitals, testing centers, quarantine facilities, and homecare units highlighted the limitations of traditional waste management systems, which struggled to handle the increased volume and diversity of waste effectively. To address these challenges, innovative solutions involving Artificial Intelligence (AI) have been introduced. One such initiative is the "COVID19BWM" software application, launched by the Central Pollution Control Board (CPCB) in May 2020. This AI-based platform allows for real-time tracking, collection, and disposal of COVID-19 biomedical waste. It facilitates information exchange between key stakeholders, including waste generators, handlers, treatment facilities, and pollution control boards, ensuring better accountability and management of waste. The application serves as a comprehensive tool to monitor waste flow from healthcare facilities to treatment sites, ensuring compliance with safety standards and minimizing environmental risks. By harnessing the power of AI, India has taken a significant step toward addressing the complex challenge of biomedical waste management during the pandemic, offering a blueprint for sustainable waste handling in the future.*

Keywords*:*

Knowledge, Attitude and Practices of Biomedical Waste Management among Health personnel in Tertiary care Hospital, Guntur

Rajeshnandan G, Muhseenah*, Purnamma R
Department of Community Medicine, Guntur Medical College, Guntur, Andhra Pradesh, India
**Corresponding Author: muhseenahwork@gmail.com*

ABSTRACT: *Need for study: 85% of the hospital waste is non-hazardous, 15% is infectious/hazardous. Mixing of hazardous results in to contamination and makes the entire waste hazardous. Hence there is necessity to segregate and treat. Improper disposal increases risk of infection; There is an inevitable need for healthcare professionals to have adequate knowledge and a proper attitude towards BMW and its management*
Purpose: 1. To asses level of knowledge, attitude and practices of Hospital waste management among Health Care personnel. 2. To compare knowledge, attitude and practices of Hospital waste management among Health Care personnel.
Methodology: Cross sectional Observational study involving 790 participants conducted between June 2024 to October 2024 at Government General Hospital, Guntur. A Predesigned semi structured questionnaire was used to collect data. Data was analysed by using SPSS Software trial version 23 and presented as frequencies and percentages. The association between different variables was analysed by the chi-square test.
Results: Most of the doctors (42.3%) and nurses (41.5%) had Excellent knowledge of Bio-Medical Waste Management (BMWM) but only (30.1%) of laboratory technicians and Sanitary workers (28.2%)showed Excellent knowledge. All the participants had a very good attitude (80.2%) towards BMWM. Regarding Practice needs improvement in some aspects like Post Exposure Prophylaxis (PEP) (37.2%) & PPE while handling BMW(40%)
Conclusion: From the study, it is identified that knowledge regarding Biomedical Waste Management is comparatively less among the lab technicians & Sanitary workers. Need more training on some aspects like needle stick injury, Post Exposure Prophylaxis (PEP) & maintaining record for BMW through lectures, symposiums, quiz & role plays.

Keywords*: Biomedical Waste Management, Health care workers, Knowledge, attitude and practice study, Needle stick injury, Post-exposure prophylaxis.*

Assessment of municipal and biomedical waste management in Kandahar city, Afghanistan

Khadem Hussain Saeedi*, C. Manjulatha
Department of Zoology, Andhra University, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: Khadem.saeedi@gmail.com*

ABSTRACT: *Environmental issues in developing countries are primarily caused by rapid population growth, inadequate infrastructure, and insufficient public cooperation in solid waste management. Moreover, properly managing biomedical waste in public health centers is crucial. The present paper provides a comprehensive analysis of the state of municipal solid waste (MSW) and biomedical waste management in the city of Kandahar. The city has experienced a significant rise in population due to immigration, resulting in increased urbanization and industrialization. This has led to the accumulation of substantial quantities of hazardous and non-hazardous solid waste in public areas over extended periods. A survey conducted across 10 districts with 250 individuals revealed that 26.4% dispose of waste in open areas, 2% burn their waste, and 2.8% discharge it into drainage systems. Solid waste transportation primarily occurs during peak morning hours, causing congestion. Likewise, research conducted in 15 districts across public and private healthcare centers indicated significant shortcomings in handling biomedical waste. Qualitative and quantitative data collected through questionnaires and observations revealed that 65.3% of newly hired biomedical waste staff needed adequate training. Additionally, the municipality regulates 44% of generated biomedical waste, but color-coding practices must be followed appropriately. The current biomedical waste management practices do not meet international standards, or the criteria suggested by the World Health Organization. This research emphasizes the pressing necessity for the development of more effective waste management approaches as a means of addressing the escalating environmental and public health issues that exist within Kandahar City.*

Keywords*: Solid Waste Management, Biomedical Waste, Environmental Challenges, Kandahar City, Public Health.*

Bio Economy initiatives in Mexico

Gabriela Munoz-Melendez*
El Colegio de la Frontera Norte
**Corresponding Author: gmunoz@colef.mx*

ABSTRACT: *In Mexico, there are few academic studies on Bioeconomy, these have focused on technical issues such as extraction, biorefinery, biomass and residues, leaving behind social and economic aspects. Currently, there are not public policies to advance bioeconomy, neither the identification of relevant actors in the value chains to value natural and biological resources. However, the government of Mexico recognizes the potential of bioeconomy for the agricultural sector, as an alternative for economic development in rural settings to promote eOiciency on the use of natural resources at the same time than foster economic and social development in rural communities. Such recognition has consolidated on the 2023 Sectoral Strategy of Agricultural Bioeconomy (ESBAM for its acronym in Spanish) for Mexico this is comprise of four areas: 1) Transformation towards sustainable and circular systems, 2) Use of agricultural biomass, 3) Innovation, science and technology, and 4) Strengthening governance. The ESBAM considers the generation of biofuels, biogas, use of biological residues and agricultural waste as well as the food waste reduction. So far, the ESBAM is still in its early stages.*

Keywords*:*

III.
Circular Economy

Five Questions on Blockchain for Sustainability and Circular Economy

Vijaya Kittu Manda[1,*], Bhukya Madhu[2]

[1]BEST Innovation University, Gorantla, Andhra Pradesh, India

[2]KG Reddy College of Engineering & Technology, Hyderabad, Telangana, India

**Corresponding Author: vijaykittu@hotmail.com*

ABSTRACT: *Existing Information and Communication Technologies (ICT) are massive consumers of energy and are criticized for not being sustainable and circular economy friendly. However, the applications that arise from the use of technology can immensely optimize the processes and benefit the overall system. This review raises five questions about the potential of Blockchain potential to revolutionize the way we produce, consume, and manage resources.*

The first question focuses on the fundamental concepts of Blockchain and how it relates to Sustainability and the Circular Economy. The second question deals with Blockchain use to track and verify the environmental impact of products and services. The third question showcases how Blockchain-based solutions can be used for waste management, recycling, and resource efficiency. Fourth question is on how can Blockchain support the development of sustainable supply chains and product lifecycles. Finally, the fifth question examines the challenges and opportunities for adopting Blockchain to drive sustainability and the circular economy, including scalability, regulation, and stakeholder engagement-related issues.

This paper gives stakeholders an overview of the current state of Blockchain for sustainability and the circular economy and identifies key challenges and opportunities for future research and development. The paper concludes that Blockchain has the potential to play a significant role in creating a more sustainable and circular economy but that further research and development are needed to overcome the challenges and realize the full potential of the technology.

Keywords*: Blockchain, sustainability, circular economy, waste management, recycling, resource efficiency, supply chain management, product lifecycle management, environmental impact, impact assessment.*

Promoting Circular Economy in India: Sustainable Waste Management through WtE

Swarna Bharathi Yeluri*

NBM Law College (Affiliated to AU), Visakhapatnam, A.P, India

**Corresponding Author: ysb840717@gmail.com*

ABSTRACT: *This paper explores the potential of Waste-to-Energy (WtE) as a sustainable waste management strategy in India, highlighting its benefits for both citizens and eco-industrial parks. Rapid urbanization and industrial growth have intensified the problem of non-recyclable waste, leading to severe pollution of air, water, and land. WtE offers a sustainable solution by converting non-recyclable waste into energy, thus reducing landfill volumes and generating renewable energy. This paper draws on successful examples from Sweden, Japan, and Germany, detailing advanced WtE techniques such as high-efficiency incineration, gasification, and combined heat and power (CHP) systems. Notably, India has yet to fully embrace these WtE technologies. Therefore, the paper emphasizes the need for robust policies, technological advancements, and community engagement to effectively implement WtE in India. Enhancing public awareness and participation in waste segregation is crucial for improving the quality of feedstock for WtE plants. Integrating WtE with eco-industrial parks can foster circular economy principles, promoting efficient resource use and environmental sustainability. By adopting and adapting global best practices, India can address its waste management challenges, paving the way for a cleaner and more sustainable future. This paper underscores the potential of WtE as a cornerstone of India's waste management strategy, focusing on waste minimization, resource efficiency, and renewable energy generation. .*

Keywords*:*

Weaving a New Narrative - A Scoping Review on the Role of Narrative Economics in Creating Responsible Consumption Patterns in Fashion

Nikita Yadav*
India
**Corresponding Author: nyadav7@gitam.in*

ABSTRACT: *Demand for a product drives its supply, and this stands no different for the fashion industry, where the exponential growth of consumers drives an increasing demand for more products each year. The environmental impact of the same is not less known to society at large. Rising production leads to a subsequent increase in waste, which results in a pile of clothing that is often less used, sometimes unused, or underutilized. This raises environmental concerns as neither the demand nor the supply appears to be cooling down considering the shoot in demand of 400% over the past two decades (ref. Fashion United). This fact highlights the need to focus on the consumer's part of responsibility regarding SDG 12 "responsible consumption and production". It is henceforth imperative to focus on the consumer's responsibility to demand the right thing, and how concepts of Narrative Economics (a new field of economics discovered by Robert J. Shriller) can be used to alter and influence the economic decision of the consumer by a simple act of storytelling. This scoping review aims to direct us on how existing concepts of narrative economics can help us reduce the hyping of consumerism in fashion and create a much more sustainable model to follow.*

Keywords*:*

Solid Waste Management System for Residential and Commercial Areas in Cuttack City, India

Dibya Jivan Pati*, Jyoti Mishra
School of Architecture, GITAM Deemed to be University, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: architects.transform@gmail.com*

ABSTRACT: *Purpose: Uncontrolled growth rate of the population in urban areas have led solid waste generation and management to become a significant concern in India. Inefficient solid waste collection resulted in illegal dumping in local or neighborhood areas, which further impacts health. In most cities, lack of funds from urban local bodies (ULBs) also resulted in several solid waste problems. Design/methodology: This research presents a strategy for estimating solid waste generation for the study area – Cuttack city, India. Accordingly, efficient collection systems, effective disposal methods and cost benefit analysis were designed to achieve circular economy and fulfil the requirement of Sustainable Development Goals-12 (SDG). The study was divided into four stages – primary data collection, secondary data collection, analysis and result, and discussion with all data projected until the year 2030. Findings: Based on the primary survey in 2021, it was found that 70% of households showed their willingness to separate/recycle and willingness to pay for different municipal solid waste (MSW) services, which helped the author determine the extent of MSW management services in 2030. Originality/value: This research proposes a strategy for enhancing the quality of the MSW management that requires detailed economic and operational feasibility analysis. It depends on user charges from every household (h.h.) to make their implementation successful, due to which solid waste management.*

Keywords*: Waste generation, Circular economy, disposal, residential, commercial.*

Circular Solutions for Coastal Sustainability: A Case Study of Visakhapatnam's Journey Towards Sustainable Waste Management

Chitra Saxena Nagpal*, Anita Rao Raviwada, Rajasagi Harish Kumar Varma

GITAM School of Law, GITAM (Deemed To Be) University, Rushikonda, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: cnagpal@gitam.edu*

ABSTRACT: *Anthropogenic activities have been posing an unprecedented risk to the health of coastal ecosystems worldwide, with waste management playing a decisive role in determining their resilience. This article analyzes the transformational journey of Visakhapatnam, a prominent coastal city in India, towards sustainable waste management practices within the framework of circular economy principles. The coastal ecosystem of Visakhapatnam witnesses intense maritime traffic, and as a result, is facing significant challenges from waste generation and its disposal. This study examines the waste management practices of two major establishments in Visakhapatnam's coastal zone: the Visakhapatnam Port Trust and the Indian Navy's Eastern Naval Command, by conducting empirical research on several critical areas such as marine litter, ship-generated waste, dredging waste, solid waste, oil spill, plastic waste, and e-waste. Moreover, the article also delves into air quality management and biodiversity conservation in Visakhapatnam's coastal ecosystem, while analysing community engagement strategies leading towards a circular economy. Additionally, the research endeavours to assess the current waste disposal methods against sustainability, thereby providing insights for moving towards a more environmentally sound practice in maritime waste management. The article assesses the environmental and economic impacts of current waste management practices with a special focus on the specific challenges and opportunities in Visakhapatnam's port and naval facilities. It evaluates the potential benefits of transitioning to a circular economy model. By reimagining waste as a potent resource within the circular economy framework, current challenges have the potential to transform into opportunities for sustainable global development.*

Keywords*:*

Role of Circular Economy in Managing Municipal Waste of Delhi

Vijaya Lakshmi Bhati*, Amrita Shukla

India

**Corresponding Author: vijyab76@gmail.com*

ABSTRACT: *Environmental issues in developing countries are primarily caused by rapid population growth, inadequate infrastructure, and insufficient public cooperation in solid waste management. Moreover, properly managing biomedical waste in public health centers is crucial. The present paper provides a comprehensive analysis of the state of municipal solid waste (MSW) and biomedical waste management in the city of Kandahar. The city has experienced a significant rise in population due to immigration, resulting in increased urbanization and industrialization. This has led to the accumulation of substantial quantities of hazardous and non-hazardous solid waste in public areas over extended periods. A survey conducted across 10 districts with 250 individuals revealed that 26.4% dispose of waste in open areas, 2% burn their waste, and 2.8% discharge it into drainage systems. Solid waste transportation primarily occurs during peak morning hours, causing congestion. Likewise, research conducted in 15 districts across public and private healthcare centres indicated significant shortcomings in handling biomedical waste. Qualitative and quantitative data collected through questionnaires and observations revealed that 65.3% of newly hired biomedical waste staff needed adequate training. Additionally, the municipality regulates 44% of generated biomedical waste, but color-coding practices must be followed appropriately. The current biomedical waste management practices do not meet international standards or the criteria suggested by the World Health Organization. This research emphasizes the pressing necessity for the development of more effective waste management approaches as a means of addressing the escalating environmental and public health issues that exist within Kandahar City.*

Keywords*: solid waste management, biomedical waste, environmental challenges, Kandahar City, public health*

Resource Recovery Potential for Circular Economy in Bhutan's Waste Management Initiative

Krishna Lal Chhetri*
School of Science, Edith Cowan University, 270 Joondalup Drive, Perth, Western Australia
**Corresponding Author: krishnac@our.ecu.edu.au / toto.krishna@gmail.com*

ABSTRACT: *Bhutan's socio-economic development began in 1961 aiming to create basic infrastructure in transport, communication system, power, agriculture and animal husbandry. Alongside the growth of urban centres and population, increased waste generation has led to waste management problems in recent times. In order to subside the evolving waste management issues, the Royal Government of Bhutan has established policies that could easily deal with the proportionate amount of waste generated by its population. However, lack of awareness among citizens has rendered the implementation of policies ineffective. This study considers ineffective policy implementation leading to huge amounts of recyclables and resources lost to landfill that could potentially be recovered for circulation in the economy of developing Bhutan. Statistical data from national publications, international agencies' reports, and peer reviewed journal articles are analysed quantitatively to project resources lost to landfill against the per capita waste generation by the estimated population growth in a specified time period. Substantial amount of waste containing recyclables are landfilled every day. By 2030, more than 88,000 tonnes of organic waste (58% of total waste generation), a source of biogas and about 1800 tonnes of the least occurring waste component, metal (1%) will end up in landfills. Recovery of materials from other waste composition like paper, plastic, textile, glass and electronic waste not only reduce landfill waste but also generate income at individual, household and community level by transitioning from linear to circular economy. Bhutan is in the early phase of waste management problems therefore, require deeper research to implement effective measures and strategies adopted by other developing and developed countries to create circular economy in waste sector.*

Keywords*: Resource recovery, recyclables, landfill waste, circular economy*

Accelerating Circular Economy using Digital Transformation

Vijay Karna*
Digital Transformation Executive, Cyient Ltd., India
TOGAF Distinguished Architect, Certified Sustainability Reporting practitioner from CII, India
**Corresponding Author: Vijaykarna.attaluri@cyient.com*

ABSTRACT: *Purpose: This paper addresses pressing environmental challenges like climate change, resource depletion, and waste generation by examining how digital technologies can accelerate the transition to a circular economy. The aim is to show how digital transformation can enhance resource efficiency, foster sustainable economic development, and create new business models that reduce waste and pollution. Design/methodology/approach: The paper reviews existing literature and case studies to explore the role of digital technologies such as IoT, big data, and blockchain in supporting circular economy principles. It analyzes circular business models like product-as-a-service and circular leasing and examines their implementation across various industries. Additionally, the paper discusses policies and regulations that can facilitate the adoption of circular economy practices. Findings: The study reveals that digital transformation significantly aids in implementing circular economy strategies by improving resource use efficiency, supporting circular design, and enabling new business models. Case studies illustrate how organizations effectively use digital technologies to adopt circular economy principles, leading to reduced waste and better resource management. Implications: The findings offer practical insights for businesses, policymakers, and researchers interested in promoting sustainable development through circular economy practices. The paper highlights how digital technologies can be harnessed to create sustainable business models, informs policymakers about necessary regulatory frameworks, and identifies areas for further research. Originality/value: This paper contributes to the emerging field of digital transformation within the circular economy by providing a fresh perspective on how digital technologies can drive sustainable innovation. It offers valuable insights and practical examples for both practitioners and academics, emphasizing the importance of integrating digital solutions for a sustainable future.*

Keywords*: • Circular economy, • Digital transformation, •Sustainability, • Environmental challenges, • Climate change.*

Right to Repair: Perspectives from India

Karthik Krishnan[1,*], Arunima Rana[2]
[1]Indian Institute of Foreign Trade, India
[2]Marketing, Indian Institute of Foreign Trade, India
**Corresponding Author: Karthik_phdmp22@iift.edu*

ABSTRACT: *Purpose: Globally the Right to Repair movement has gained significant momentum. This movement advocates for consumers' right to repair and maintain their products, thereby prolonging the life of products, reducing the generation of waste, and promoting sustainability. Various developed countries like the USA, Europe, Australia, etc. are at different stages of implementation of the Right to Repair. The Ministry of Consumer Affairs in India has also launched a Right to Repair platform to empower customers and create a framework for the legislation. It is critical to understand the perspectives of different stakeholders while creating the legislature for effective implementation. The paper aims to understand the requisites of the framework from the viewpoint of the key stakeholders especially in the Indian context which is significantly different from the developed economies. Approach: The key stakeholders identified include the Consumers, Manufacturers, Third-party repair shops, and the government. In addition, the paper also treats the product as a stakeholder considering each product has a different environmental impact across its lifecycle. The authors have adopted a narrative literature review method to delve into the topic. Recommendations: The paper recommends carrying out a Lifecycle assessment of products to determine their environmental impact, revisit the IPR laws to protect the interest of stakeholders, create awareness amongst consumers, and endorse genuine repair service providers amongst others while developing a robust policy.*

Keywords*: Right to Repair, Third-party-repair, e-waste, sustainability, circular economy.*

Leveraging Advanced Manufacturing Technology and House of Quality for Sustainable Transformation in the Circular Economy

Musebe Edward Achieng*

United States International University-Africa (USIU-A) and Registered Engineer with Engineers Board of Kenya

**Corresponding Author: emusebe1@usiu.ac.ke*

ABSTRACT: *The adoption of Advanced Manufacturing Technology (AMT) and House of Quality (HoQ) methodologies in the production process plays a pivotal role in driving the transition towards a Circular Economy (CE). This paper explores how integrating AMT—such as employing design technologies, planning technologies and manufacturing technologies—enables industries to enhance resource efficiency, reduce waste, and promote the recycling and reusability of materials throughout product life cycles. Additionally, the application of the HoQ framework facilitates the alignment of customer requirements with sustainable design and production processes, ensuring that products meet environmental expectations while retaining quality and functionality as desired by customers. By linking AMT capabilities with HoQ practices, businesses can innovate more sustainable product designs and manufacturing processes, helping close material loops and reduce environmental impact. This study highlights key synergies between AMT, HoQ, and CE principles, offering insights into how technological advancements and strategic product planning can accelerate circular economy objectives, thereby fostering sustainable industrial transformation.*

Keywords*: Advanced Manufacturing Technology, House of Quality, Circular Economy.*

Solid Waste Management Practices in School under the Mission, "Catch Them Young: Zero Waste & Circular economy In Campus": Case Study in Kolkata, West Bengal

Chaitali Mukherjee[1,*], Purbali Roy[1,*], Piyali Biswas[1,*], Sadhan Kumar Ghosh[2]

[1]Santoshpur Rishi Aurobindo Balika Vidyapith, Kolkata

[2]International Society of Waste Management, Air and Water, Kolkata, India

**Corresponding Author: chaitalimukherjee753@gmail.com, purbaliray@gmail.com, piyalibiawas1974@gmail.com*

ABSTRACT: *The availability of clean water, sanitation, sustainable production and consumption are the focuses in SDGs 6 & 12. For sustainable waste management the system needs to be effective from the school level which is an urgent need indeed attracting immediate attention. The teacher's SWM knowledge is essential with particular emphasis in developing countries to educate school children. Primary and Secondary levels of schools are responsible for preparing future citizens to be more confident and creative in spreading SDGs. Nearly 1150 students, teachers, and staffs in Santoshpur Rishi Aurobindo Balika Vidyapith [girls' school], has started the practice of effective waste management on April 12, 2024 by implementing a focused systems under the mission – "Catch them young: Zero waste and circular economy in Campus" conceptualized by International Society of Waste Management, Air and Water. It includes bin culture adoption by the all in the school, segregation all wastes in 3-bin system and utilize the waste generated & stored for business of recycled products as a part of circular economy and resource efficiency. This study observes the paradigm shift in waste management taking place slowly in the cultural among the students, teachers & staffs. The processes involved in the mission for practice are: Awareness generation, day-to-day practice of waste segregation, biodegradable wastes used for composting in Micro Composting Plant (MCP), clean & useful dry waste are used by students to make handcrafted recycled products and the rests are sold to waste collectors. The compost is used for roof top kitchen garden. The recycled products made by students are sold through exhibition and auction, the income of which becomes the earning of respective the student who made it. The management of the system is monitored by the waste management class monitor under the supervision of teachers' group bringing multifold benefits for the school as well for the society and the environment. The mission is unique in nature in India for achieving sustainable environment.*

Keywords*: Circular Economy in school, Treatment, Sale of Recycled Products, Waste-to-Business, Waste Utilisation in school.*

Rethinking Brickmaking: How Circular Economy Principles Can Drive Sustainable Construction in Developing Regions

Ravi Shankar Saripalle*, Raja P Pappu, Sai Sudhakar Nudurupati
GITAM School of Business, GITAM University, India
**Corresponding Author: rsaripal3@gitam.edu*

ABSTRACT: *Traditional brick-making in India contributes significantly to environmental degradation through high CO2 emissions and topsoil depletion. This study examines the impact of Fly ash-Lime-Gypsum (FaL-G) technology as a sustainable alternative in the Indian construction industry. Using a qualitative case study approach, including document analysis and inventor interviews, authors explore how FaL-G penetrates into conventional practices by eliminating coal and clay use. The research investigates strategies facilitating FaL-G's widespread adoption, such as open innovation, carbon finance integration, and community engagement. Findings highlight FaL-G's role in reducing emissions, conserving resources, and repurposing industrial waste, while creating economic opportunities. The study contributes to sustainable innovation literature, offering insights for policymakers and entrepreneurs in developing markets. FaL-G shows how sustainable technologies can effectively address environmental challenges in construction.*

Keywords*: Sustainable construction, FaL-G technology, Brick-making, Emissions reduction, Waste utilization.*

From Waste to Resource: A Circular Economy Approach to Waste Management in India

Vaniya Sharma*, Raghav Tayal, Vishal Srivastava
School of Engineering & Technology, Vivekananda Institute of Professional Studies -Technical Campus, Delhi, India
**Corresponding Author: vaniyasharma23@gmail.com*

ABSTRACT: *India's waste management system faces significant challenges. Current practices are insufficient, leading to pollution and health risks. The country produces approximately 62 million tonnes of waste annually, with a mere 20% recycled. A concerning 8.7 million tonnes of this waste is classified as hazardous. Given the substantial contribution of the Fast-Moving Consumer Goods sector to the Indian economy, prioritizing effective waste management is crucial. Sustainable solutions are essential for the future of waste management in India. These include promoting recycling and composting, and implementing waste-to-energy technologies. Such methods not only divert waste from landfills but also contribute to resource conservation and energy recovery. A "business as usual" approach, however, paints a bleak picture. Projections suggest only a slight increase in recycling capacity to 11% by 2035, while plastic usage is predicted to surge from 70.5 million tonnes to 24.1 metric tonnes. These alarming statistics, highlighted in "India's National Circular Economy Roadmap to Reduce Plastic Waste," a collaborative report by Indian and Australian research institutions, underscore the urgent need for action. With appropriate governmental policies and community involvement, India can transform its waste management system and create a more sustainable future.*

Keywords*: Waste Management, Recycling, Composting, Circular Economy, Reduce Plastic Waste.*

Integrating Circular Economy Principles in Physiotherapy: Towards Sustainable Practices in Rehabilitation

Seema Saini*
India
**Corresponding Author: seema.saini@dpu.edu.in*

ABSTRACT: *Background: The healthcare sector, including physiotherapy, significantly contributes to global waste generation, with estimates suggesting that healthcare-related waste comprises approximately 10% of total waste. As sustainability becomes a crucial focus in healthcare, integrating circular economy principles into physiotherapy practices presents an opportunity to minimize waste and enhance resource efficiency. Methodology: This study employed a qualitative approach, reviewing existing literature and analyzing case studies of physiotherapy clinics that have successfully implemented sustainable waste management strategies. Data were gathered from academic journals, reports, and interviews with physiotherapy professionals engaged in sustainable practices. Thematic analysis was used to identify common trends, challenges, and innovative strategies. Results: The findings revealed several effective strategies for promoting sustainability in physiotherapy, including the use of reusable equipment, adoption of digital tools for patient management, and collaboration with sustainable suppliers. Case studies highlighted successful clinics that achieved significant waste reduction through eco-friendly materials and community engagement. Notably, clinics reported up to a 70% reduction in waste by implementing these practices. Conclusion: Integrating circular economy principles into physiotherapy practices offers a viable pathway to reduce environmental impact while enhancing patient care. The study underscores the importance of educating physiotherapy professionals about sustainable practices and encourages further research to explore long-term outcomes and scalability of these initiatives within the profession.*

Keywords*: Physiotherapy, circular economy, sustainable practices, waste management, rehabilitation.*

Upcycling Tomato Waste for Sustainable Lycopene Extraction Using Edible Oils and its Biopolymeric Encapsulation: A Circular Economy Approach

Kanchan A. Nandeshwar, Shyam M. Kodape*, Ajit P. Rathod
Department of Chemical Engineering, Visvesvaraya National Institute of Technology, Nagpur, India
**Corresponding Author: smkodape@che.vnit.ac.in*

ABSTRACT: *This study explores the upcycling of overproduced tomato waste from the Nagpur region of Maharashtra, India, through the sustainable extraction of lycopene. In this research, we aim to showcase a viable waste-to-resource strategy, aligning with circular economy principles, by converting tomato processing waste into a high-value product. Purpose: This study aims to upcycle tomato waste by extracting lycopene from overproduced tomato waste, utilizing edible oils and encapsulating the extract with biopolymers to promote sustainable waste management and resource recovery. Design/Methodology/Approach: The extraction process was conducted using various vegetable oils, including groundnut, soybean, coconut, sunflower, and mustard oil. A central composite design of response surface methodology was employed to optimize extraction conditions such as solvent-to-material ratio, temperature, and time. The optimized process was validated experimentally. Findings: The highest lycopene yield of 53.78% was achieved using coconut oil under optimal conditions of 30°C, a 10:1 solvent-to-material ratio, and a 45-minute extraction time. Following extraction, ionic gelation was utilized to form lycopene-rich beads using sodium alginate, pectin, and gelatin as encapsulating agents, achieving an encapsulation efficiency of 61% at 30°C with 1.5g lecithin. Implications: This study demonstrates the potential for converting tomato processing waste into valuable lycopene products, contributing to a circular economy by reducing waste and creating high-value ingredients for cosmetics, functional foods, and dietary supplements. Originality/Value: The research highlights an innovative approach to sustainable lycopene extraction and encapsulation from agricultural waste, presenting a viable method for the food and cosmetics industries to minimize environmental impact while maximizing resource efficiency.*

Keywords*: Lycopene extraction, Tomato waste, Upcycling, Circular economy, Ionic gelation.*

Zero-Waste Vegetable Gardening: A Path Toward Sustainability in the Circular Economy

MD Sadik Pasha[1,*], J. Cheena[2], M. Soniya[1], M. Shruthi[3], K. Nagaraju[4]

[1]Dept. of Vegetable Science, SKLTGHU, Mulugu, India
[2]College of Horticulture, Malyal, Mahabubabad, India
[3]Department of Entomology, College of Horticulture, Malyal, Mahabubabad, India
[4]VR Horticultural Research Station, Malyal, Mahabubabad, India

**Corresponding Author: mdsadik4171@gmail.com*

ABSTRACT: *Zero-waste vegetable gardening provides a sustainable, eco-friendly solution to food production by integrating waste reduction and resource reuse, closely aligned with the principles of the circular economy. Unlike conventional gardening methods that rely on synthetic fertilizers and generate waste, zero-waste gardening focuses on practices like composting, mulching, seed saving, and water conservation to create a self-sustaining system. Transforming organic waste into nutrient-rich compost naturally improves soil fertility, reducing the need for chemical inputs. Mulching conserves water, regulates soil temperature, and suppresses weeds, while seed saving promotes biodiversity and reduces dependence on commercial seeds. Water conservation techniques such as rainwater harvesting and drip irrigation further reduce water waste, making zero-waste gardening particularly effective in regions with limited water resources. This paper demonstrates how these sustainable practices not only lower environmental impact and reduce waste but also offer significant economic benefits by cutting gardening costs. Additionally, zero-waste gardening fosters community resilience by encouraging local food production and supporting long-term soil health. By adopting these practices, gardeners can play an active role in closing nutrient loops and promoting sustainability, making a meaningful contribution to a more environmentally friendly future. Zero-waste gardening is a practical and powerful tool to support the transition toward a more circular and regenerative economy, making it a valuable approach for gardeners, communities, and the environment as a whole.*

Keywords*: Zero-waste gardening, Circular economy, Composting, Water conservation, Biodiversity, Waste management.*

Circular Economy Adoption in SMEs: Key Drivers, Stakeholder Roles and Technological Innovation

Mukesh Kondala, Sunil Kumar, Nisha Kumari*

India

**Corresponding Author: nkumari4@gitam.in*

ABSTRACT: *Numerous international organisations have recently acknowledged the need to move from the traditional linear production system to a more circular and sustainable production and consumption approach. The Circular Economy (CE), characterised by its pursuit of a restorative and regenerative economic framework, draws exponential consideration from researchers and policymakers. This paper investigates the interplay between various drivers of CE, the roles of stakeholders, and the adoption of technology by Small and Medium Enterprises (SMEs) in implementing circular practices, as well as the consequent effects on the sustainable performance of these enterprises. The primary data for this study was collected through a structured questionnaire administered to SMEs in Visakhapatnam, India, providing valuable insights into their current practices and challenges in adopting circular economy principles. The outcomes of this research include a comprehensive understanding of how SME engagement with CE can enhance their sustainability performance. The study aims to provide actionable recommendations for SMEs looking to adopt circular practices by testing the key drivers and stakeholder influences. Furthermore, it will elucidate how technological adoption plays a crucial role in facilitating this transition. The contribution of this paper is twofold: first, it adds to the existing literature on the circular economy by focusing specifically on the experiences of SMEs, and second, it offers practical insights that can guide policymakers and industry leaders in fostering a more sustainable and resilient economic landscape. Ultimately, this research seeks to empower SMEs to embrace circular economy principles, thus contributing to broader sustainability goals.*

Keywords*:*

Implementing Circular Economy Principles in Film set Material Upcycling: An Assessment Framework

Kushi Singhvi*, Surekha K C
Manipal School of Architecture and Planning, Manipal Academy of Higher Education, Manipal, India
**Corresponding Author: kushi.singhvi@learner.manipal.edu.com*

ABSTRACT: *The film industry, while celebrated for its creativity, is a significant contributor to environmental pollution due to the frequent construction and dismantling of temporary film sets. This research investigates how principles of the circular economy can address these waste management challenges, particularly by promoting the reuse, recycling, and upcycling of construction materials used in film production. Through a case study methodology involving document analysis, interviews, and examples from various global regions, the study identifies key barriers to effective waste management within the industry. Notably, it aims to develop a framework specifically suited to the Indian context, where formal guidelines for sustainable film set practices are currently lacking. A key outcome of this research is the classification of four types of materials—timber, metals, plaster, and cardboard—that hold significant potential for systematic recycling and reuse on film sets. The findings indicate that adopting circular economy principles in the recycling of these materials could reduce film set waste by up to 50%, providing substantial environmental and economic benefits. Furthermore, the study introduces an upcycling framework designed for the Indian film industry, drawing on successful practices from other regions, while aligning with global sustainability goals, particularly Sustainable Development Goal (SDG) 12, which emphasizes responsible consumption and production.*

Keywords*: Circular economy, film set upcycling, sustainable set design, material reuse, assessment.*

Circular Economy in the Indian Pharmaceutical Industry: A Pathway to 2045

Nikhil Narwariaa*, Ramarao Poduri
India
**Corresponding Author: nnarwari@student.gitam.edu*

ABSTRACT: *The circular economy (CE) offers a sustainable alternative to the linear "take-make-dispose" model, focusing on efficient resource use and waste reduction. The Indian pharmaceutical industry, valued at $50 billion, contributes 3.5-4.5% of India's greenhouse gas emissions, 12.6% of global pharmaceutical emissions [1]. To achieve net-zero emissions by 2070, it must cut its carbon footprint of 13.4 million tons CO2e (equivalent) annually [2]. Fossil fuel consumption is the largest contributor: 55-60%, raw material extraction: 20-25%, water usage: 10-15%, and waste generation: 5-10% of emissions [3].The industry is adopting renewable energy, energy-efficient manufacturing, green chemistry, sustainable supply chains, etc. Companies like Sun Pharma, Cipla, and Dr. Reddy's Laboratories aim for carbon neutrality by 2045. Flow chemistry and photochemistry enhance sustainability by minimizing reagent use and utilizing solar energy, while Returnable Transport Items and closed-loop supply chains reduce packaging waste and recycle unused drugs. Companies like Sanofi and Boehringer Ingelheim are adopting eco-design, switching to reusable inhalers and plastic-free packaging, including the use of returnable transport items [4].Employing the 9R/10R framework (refuse, reduce, reuse, recycle, recover, redesign, remanufacture, restore, reintegrate, regenerate) is enhancing financial sustainability and creating new revenue streams. Bio circularity combines CE principles with ecological frameworks for resilience [5]. Collaboration, continuous innovation, and supportive regulations are vital for success in the circular economy. Opportunities include drug repurposing—such as N. Narwaria's work on montelukast for epilepsy [6], eco-design, dosage optimization, extending product lifetimes, Life Cycle Assessment, all contributing to a sustainable future for the industry and achieving Carbon Neutrality.*

Keywords*: Circular Economy, returnable transport items, zero carbon footprint.*

Circular Economy Initiatives for Plastic Waste Management in India and Vietnam – A Comparative Analysis of Plastic Economy

Nguyen Hong Quan[1,2,*], Nguyen Minh Tu[1], Sadhan Kumar Ghosh[3]

[1]Institute for Circular Economy Development, Vietnam National University-Ho Chi Minh City (VNU-HCM), Vietnam
[2]Institute for Environment and Resources, VNU-HCM, Vietnam
[3]Sustainable Dev. & Circular Economy Research Centre, ISWMAW & Founder Advisor, CSD&REM, Formerly Jadavpur University, India

**Corresponding Author: nh.quan@iced.org.vn*

ABSTRACT: *Plastic waste has become the major problem worldwide with respect to its use, littering, disposal even a few recycling processes on land and in the marine environment. It is one of the largest challenges in the society, driven by multiple and interconnected technical, social, and economic actors along the plastic waste value chain. The recent study report confirms the transition to circularity is firmly established and is picking up pace in Europe while the use of recycled plastics has increased by 70% since 2018, and circular plastics now make up 13.5% of all plastic resins converted into new products and components in Europe. When benchmarked against the "Plastics Transition" roadmap, the plastics system is more than halfway towards realising the ambition of achieving 25% circular plastics by 2030. In 2023, Vietnam's plastic product output exceeded 10 million tons from nearly 4,000 plastic companies, 90% of which are small and medium enterprises. China, India, the United States and Japan will account for 51 per cent of the total volume of 3,153,813 tons of micro plastics into the world's waterways, while according to the 2024 Plastic Overshoot Day (POD) Report, India will release 391,879 tons of micro plastics. Currently, different frameworks and solutions to solve the problem from plastic wastes exist in various local and global contexts. This study aims to conduct a comparative analysis of how plastic wastes are managed and used in India and Vietnam by existing reports and research dat. A synthesis framework is developed to scale up suitable plastic economy pathways and lessons learned from the case studies to similar, global contexts.*

Keywords*: municipal solid waste; circular economy; frameworks; India; Vietnam.*

From Waste to Resource: Systems Dynamics and Material Flow in the 9R Circular Economy

Unmilan Kalita*, Dhritiraj Sarma, Leena Bhagawati

Department of Economics, Barnagar College, Barpeta, Assam, India

**Corresponding Author: sarmadhritiraj000@gmail.com*

ABSTRACT: *This paper explores the concept of the circular economy (CE) as a sustainable alternative to traditional linear economic models, focusing on the 9R framework (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, and Recover) as a central strategy for waste minimization and resource efficiency. Through the analysis of case studies and the application of Material Flow Analysis (MFA) and System Dynamics (SD) modelling, the study provides insights into the flow of materials and energy within a circular economy. MFA is used to quantify material flows and identify inefficiencies, while SD modeling offers a dynamic view of how circular strategies impact production, consumption, and waste management. The paper highlights how adopting circular strategies like reuse and recycling can extend product lifecycles, reduce resource extraction, and contribute to environmental sustainability. The study also discusses the challenges of implementing CE practices, including the need for policy reforms, new business models, and greater consumer awareness. This study demonstrates the potential of CE to decouple resource use from economic growth, reduce environmental degradation, and create new economic opportunities.*

Keywords*: circular economy, 9R framework, material flow analysis, system dynamics, sustainability, resource efficiency.*

Enhancing Sustainability through Reverse Logistics: Sectoral Analysis and Best Practices for Improved Supply Chain Performance

Jovia J Bosco*, Diya Ann Saji, Preetha G Panicker
Saintgits Institute of Management, India
**Corresponding Author: joviajb.mbl2426@saintgits.org*

ABSTRACT: *Reverse logistics (RL) plays a crucial role in advancing sustainable supply chains by enabling the return, reuse, recycling, and proper disposal of products, thus fostering a circular economy. This paper investigates the adoption and impact of RL across five sectors—electrical and electronics, automotive, retail and e-commerce, textiles and apparels, food and beverages—offering an in-depth analysis of how RL contributes to sustainability and improved supply chain performance in each sector. While some industries, like electronics and automotive, have embraced RL through practices such as remanufacturing and component recycling, other sectors face barriers such as high costs, regulatory constraints, and technological limitations. The study also identifies key gaps in current RL practices within each sector, exploring why adoption has been inconsistent and highlighting the need for sector-specific solutions. Additionally, it addresses areas where RL processes can be optimized to overcome sectoral challenges. This research finds that implementing RL not only supports environmental sustainability but also enhances supply chain resilience, resource savings, and operational efficiency. To maximize the benefits of RL, the paper recommends focused investments in technology, supportive policies, and stronger collaborations between companies and government bodies. By advancing RL practices, companies can achieve a more sustainable and circular supply chain model, aligning with global sustainability goals while enhancing their competitive advantage. This paper aims to provide actionable insights and practical recommendations for companies and policymakers seeking to enhance supply chain sustainability through effective RL strategies.*

Keywords*: Reverse logistics, Circular economy, Sustainability, Supply chain performance.*

From Linear To Circular: Transforming Household Water Purification and Urban Water Management For A Sustainable Future

Roopal Seth*
Sirmaur, Himachal Pradesh, India
**Corresponding Author: roopal.seth@gmail.com*

ABSTRACT: *It takes little time to transform an invention into a problem, and one such example is home water purifiers. The growing number of water purifiers, spurred by worries about water-borne illnesses and poor access to clean drinking water, seriously impacts how cities manage their water and deal with waste. While these systems, especially those using Reverse Osmosis, are popular, they're not without problems. It's alarming, but these RO systems can waste up to 70-80% of the water that goes into them! To solve this problem, changing the perception of water purification is crucial. The circular economy concepts should be embraced rather than the linear 'take, make, waste' approach. This entails recovering the minerals from wastewater, developing filters that naturally biodegrade and utilizing modern biological technologies that incorporate enzymes or filters made of biological materials. Companies, such as Aquaporin and Puraffinity, use proteins and certain microorganisms to purify water, and therefore, the resources are used more rationally.*
The effect of all these home purifiers on city water systems is complicated. With so much wastewater being produced, cities must plan carefully, consider how to reuse and recycle water, and even help natural water systems recover.Adopting sustainable practices in our home water purification systems is not just a choice; it's a responsibility. Understanding the need for change is not just important; it's empowering, as sustainability starts at home. By making conscious decisions about our water usage, we can contribute to better urban water management.

Keywords*: Circular economy, Water purifier, Biological technologies, urban waste management.*

Sustainable Finance in Circular Economy: A Literature Review

Manoj S. Kamat, Vishwa Naik Raiker*, Tania Shirodkar
Srinivassa Sinai Dempo College of Commerce & Economics
**Corresponding Author: vishwa.raiker@dempocollege.edu.in*

ABSTRACT: *In the circular economy structure, sustainable growth is not only hypothetically achievable but also looks precisely assuring. Sustainable investing and financing play a crucial role in triumphing sustainable development goals. Sustainable finance and the Circular Economy are allied in a logical and intricate approach. The objective of this research is to reconnoiter this twofold domain and ascertain its chief characteristics. To attend to this objective, a comprehensive review of the literature was conducted, appended by a bibliometric analysis. A total of 467 articles from the Web of Science database were chosen for the study. A total of five different analyses were conducted to explore key themes in this twofold domain namely co-occurrence of keywords, Bibliographic coupling of authors, countries, and organizations, and lastly co-citation analysis. Innovation, performance, and management are some of the most occurring keywords the analysis further revealed China to be the country with the maximum number of articles followed by Brazil and England. Conclusively, based on an analysis, the research pinpoints future areas for potential research in sustainable finance and circular economy.*

Keywords*: Sustainable Finance, Circular Economy, Thematic Analysis, Co-Citation Analysis.*

Transforming waste management in South Africa: Circular economy solutions for a sustainable future

Mudau Dziphathu*
Dziphathu Green Tech, South Africa
**Corresponding Author: pha2chedzo84@gmail.com*

ABSTRACT: *Waste management has become a major environmental issue in South Africa. The South African Constitution (RSA, 1996) assigns the responsibility for refuse removal, refuse dumps and solid waste disposal to municipalities (Section 156(1)(a) read with Schedule 5). Although the large majority of municipalities provide solid waste services themselves, some metropolitan and district municipalities outsource the function, although this trend seems to be declining. The use of community-based delivery mechanisms is limited despite the potential for job creation. The National Policy for the Provision of Basic Refuse Removal Services to Indigent Households aims to facilitate the provision of at least basic refuse removal services to poor households at no cost to these households. South Africa faces significant waste management challenges, with alarming rates of waste generation and limited recycling. This presentation will explore innovative Circular Economy practices and policy initiatives driving change in South Africa. The presentation includes,*
1. Current waste management landscape and challenges
2. Successful case studies of circular economy implementation
3. Policy frameworks supporting waste reduction and recycling
4. Collaborative efforts between government, industry, and communities
In South Africa, there are huge opportunities for: - Waste reduction and recycling, Job creation and economic growth and the Environmental conservation and climate action to contribute to the global conversation on waste management and Circular Economy. It is reported that SWM can be a city's single largest budgetary item, with municipalities spending 20 to 50 per cent of their annual budget on MSW management, of which 50–90 per cent can go to waste collection alone. Municipalities are expected to provide services to poor households even if they cannot afford to pay.

Keywords*: waste management landscape, Policy frameworks, opportunities, municipalities, conversation.*

AI applications in the Circular Economy

Fariba Ghasemibojd*, Matthew Franchetti
The University of Toledo, College of Engineering
**Corresponding Author: fatemeh.ghasemibojd@rockets.utoledo.edu*

ABSTRACT: *In recent years, Artificial Intelligence (AI) has played a transformative role in various research fields, particularly in addressing global challenges such as waste management. As civilization and industrialization continue to expand, effective waste recycling has become a critical global issue. In this context, AI is effectively accelerating the transition toward a more circular economy by optimizing waste management, enhancing product lifecycle sustainability, and improving resource utilization. This report summarizes recent studies investigating AI applications to the three main stages of the circular economy: production, use, and recycling. It has been reviewed how much and in what ways AI contributes to the improvement of the circular economy at each stage. Furthermore, the challenges associated with implementing AI in these stages, including technical limitations, data availability, and the cost of integration, have been identified. Solutions to overcome these challenges are also proposed. The application of AI in various industries, such as construction and agriculture, within the context of the circular economy, is also reviewed. Finally, future trends in AI-driven circular economy strategies are discussed, highlighting emerging opportunities for enhanced resource efficiency.*

Keywords*: Artificial Intelligence, Circular Economy, Recycling.*

Biochar Technology for Aquaculture Productivity Towards Agriculture 4.0 and Circular Economy

Bennidict P. Pueyo, Catherine DR. Pueyo*
Department of Agricultural and Biosystems Engineering, College of Engineering and Technology, Tarlac Agricultural University, Philippines
**Corresponding Author: bppueyo@tau.edu.ph*

ABSTRACT: *Aquaculture industry is among the fastest-growing food sectors in the Philippines significantly contributing to the nations food security, livelihood and economy but it also facing significant environmental challenges such as water pollution, excessive nutrient loading and unsustainable resource use. Biochar technology, a sustainable innovation, has shown remarkable potential in enhancing productivity across various sectors, including aquaculture and agriculture.*
The utilization of biochar in enhancing water quality in a recirculating aquaculture system (RAS) successfully reduced the level of TAN at a rate of 0.56 ppm per hour for every 1kg biochar and 0.72 ppm per hour for the reduction of un-ionized ammonia in a 1 cubic meter fish tank under RAS. Biochar technology thereby improve aquaculture productivity and integrate waste outputs into agricultural systems, fostering circular economy principles thereby addressing soil health, water management, and nutrient cycling, biochar paves the way for a more resilient, efficient, and sustainable future for food systems.

Keywords*:*

Advancing Circular Economy in Construction: A Comprehensive Review of Concrete Recycling Techniques, Challenges, and Policy Implications for Sustainable Waste Management

Ravi Kumar S[1], Damarla Sai Puneeth [2,*], Haritha Ponnapalli[3]
School of Arts and Design, Woxsen University, Hyderabad, Telangana, India
**Corresponding Author: saipuneeth.damarla@woxsen.edu.in*

ABSTRACT: *With the rapid pace of global urbanization, recycling construction and demolition (C&D) waste has become essential in advancing circular economy principles within solid waste management. C&D waste accounts for over a third of global waste, with India alone contributing around 1504.4 million tons annually. Recycling practices, particularly concrete recycling, bring significant environmental benefits, conserve natural resources, and stimulate economic growth. This study examines critical recycling methods, such as soil stabilization and material recovery, to reduce dependency on virgin materials while enhancing material strength and durability. The use of recycled aggregates, asphalt, plastics, and metals in new construction is highlighted as a sustainable approach, complemented by innovations in AI and robotic sorting technology poised to revolutionize recycling processes. However, challenges such as limited infrastructure and regulatory barriers hinder widespread implementation. The study calls for strategic policies and strong frameworks to maximize the environmental and economic advantages of C&D recycling. Additionally, it advocates for deconstruction practices that prioritize material recovery, reducing landfill reliance. Integrating recycled materials into urban development enables communities to achieve sustainability goals and drives innovation in the built environment. Findings highlight the potential of C&D recycling to support a circular economy, enhance sustainability, and improve resource management in urban development.*

Keywords*: Construction and Demolition Waste, Concrete Recycling, Circular Economy, Sustainable Construction, Waste Management.*

Some solutions to promote the development of circular economy model in waste management in Vietnam

Phung Chi Sy*
Vietnam Association for Conservation of Nature and Environment
**Corresponding Author: entecvn.pcsy@gmail.com*

ABSTRACT: *The article presents the need to transform from the linear economic model to the circular ones, analyses the approach and legal basis for developing circular economy in Vietnam. Evaluating the current status of circular economy development in the field of waste management in Vietnam, including urban domestic waste, industrial waste, construction waste, agricultural and rural waste etc. Proposing solutions to promote circular economy development in the field of waste management in Vietnam, including perfecting legal instruments to promote circular economy development; enhancing research and application of technical tools to promote circular economy development in the field of waste management; developing and deploying economic tools to support circular economy models in waste management; Promoting communication tools, raising public awareness of the benefits of circular economy models in the field of waste management; Strengthening international cooperation to develop circular economy in the field of waste management.*

Keywords*:*

A Survey of the ambitions and Needs of Small and Medium-sized Enterprises in the Transition to the Circular Economy in Vietnam

Nguyen Cong Thanh[1,*], Timber Haaker[2]
[1]National Economics University, Viet Nam
[2]Saxion University of Applied Sciences, Netherlands
**Corresponding Author:*

ABSTRACT: *The paper presents the results of a survey of 69 small and medium-sized enterprises (SMEs) in the three regions of North, Central and South Vietnam. The surveyed enterprises expressed their ambition to implement the circular economy (CE) models in the future. According to the surveyed enterprises, the main motivators for adopting circular business models are linked to economic, financial, and market factors. Barriers to the adoption of circular business models are related to technological and cultural factors. SMEs in Vietnam still lack experience and knowledge about circular business models. The survey results show the need of SMEs in Vietnam to gain a better understanding of the CE approach. The findings from our survey might also support more effective adoption and implementation of the CE approach in developing countries.*

Keywords*:*

Fostering an inclusive Circular Economy

Nguyen Ngoc Ly*
Management Board Centre for Environment and Community Research (CECR)
**Corresponding Author: ly.nguyen@cecr.vn*

ABSTRACT: *The presentation focuses on fostering an inclusive circular economy by integrating informal waste collectors (IWCs) into sustainable waste management systems. IWCs, who often lack social insurance and earn modest incomes, play a crucial role in the waste value chain. They collect, sort, and transport recyclable materials to small junk shops or depots, which further process and pass these materials to recycling companies. Training programs in safety, waste separation, and recycling aim to improve the efficiency and working conditions for IWCs. Partnerships with private-sector brands promote responsible sourcing initiatives, focusing on fair wages, health benefits, and support for marginalized workers, with the goal of sourcing 100,000 tons of recycled plastics and supporting 50,000 IWCs. The presentation recommends formalizing IWCs through specific policies and financial mechanisms under Extended Producer Responsibility (EPR) frameworks, with funding to support recycling companies that employ IWCs. Institutional support, such as the National Job Fund and vocational training centers, will help IWCs transition into formal roles. Ultimately, the inclusion of IWCs in circular economy initiatives—such as Deposit Return Systems and community-based recycling models—will strengthen waste management systems and promote economic and environmental sustainability.*

Keywords*:*

Socially Driven Waste Reduction: Addressing Food Security through Circular Economy Practices in Durham, North Carolina, USA

Sujayalakshmi Devarayasamudram*, Jeremiah Ogachi Otsio
Department of Nursing, North Carolina Central University, NC, USA
**Corresponding Author: sdevarayasamudram@nccu.edu*

ABSTRACT: *Food waste and food insecurity are interwoven and pose significant challenges for communities around the world and especially with underserved populations. This paper/presentation focuses on socially driven waste reduction strategies that have addressed food waste reduction and food insecurity in Durham, North Carolina, USA. The study investigates how circular economy practices can address food insecurity and reduce food waste in Durham, NC. The main goal of this study is to create a socially driven framework that leverages community collaboration to enhance local food systems, foster sustainability, and support food access for underserved communities. A case study approach methodology was used to examine initiatives in Durham. Food recovery, community composting and urban agriculture were examined. The data from local nonprofits, government reports and community organizations were used to analyse the effectiveness of food redistribution networks, composting programs, public and private partnerships. Inter-Faith Food Shuttle, Compost Now, SEEDS Community Garden are a few key programs that were examined. The analysis showed that circular economy practices applied to food systems can significantly reduce food waste as it addresses local food insecurity. Redistribution networks support distributing surplus food to families in need. Composting initiatives transform organic waste into valuable resources and support quality food production. The study findings suggested that circular economy model with community driven efforts have improved food security & reduced environmental negative impact. These valuable insights provide guidelines to policy makers, social activists, community leaders, & voluntary agencies, The study contributed to the growing body of knowledge on sustainable urban food systems by providing a practical, replicable framework. The closed -loop approach supported repurposing food waste through community composting and redistribution programs. The study brought an insight, by incorporating circular economy practices into the food system, a resilient, sustainable, socially equitable urban food networks a self-supporting community can be developed.*

Keywords*: Circular Economy, Food Security, Community Composting, Food Waste Reduction, Urban Agriculture, Redistribution Networks, Sustainable Food Systems.*

A Comprehensive Model for Green Supply Chains: Leveraging Circular Economy and Waste Management for Sustainable Supplier Selection

Raktim Dasgupta[1,*], Sadhan Kumar Ghosh[2], Arup Ranjan Mukhopadhyay[3]

[1]JadavpurUniversity, Department of Mechanical Engineering, Kolkata, India
[2]DG, SD&CE research centre, ISWMAW, Former, Jadavpur University, India
[3]Indian Statistical Institute, SQC&OR Division, Kolkata, India

**Corresponding Author: raktimdasgupta3@gmail.com*

ABSTRACT: *In today's competitive business environment, efficient supply chain management (SCM) is crucial. Companies must form strategic, long-term partnerships with reliable suppliers, making supplier selection key. Sustainability is also critical, as businesses must address the environmental, economic, and social impacts of their operations. Reducing environmental pollution across the supply chain—from raw materials to product end-of-life—has become a central focus for businesses aiming to stay competitive and meet global sustainability standards. Supplier selection is a crucial task in supply chain management (SCM), impacting both environmental and economic outcomes. It involves evaluating factors across a product's life cycle, from procurement to end-of-life management. Integrating waste management and circular economy principles is essential in green supplier selection for reducing resource consumption, minimizing waste, and lowering environmental impact. In addition, the selection of a single supplier can be particularly beneficial for fostering long-term relationships, improving quality consistency, and aligning with Deming's 14 Points, which emphasize continuous improvement, close supplier relationships, and long-term commitment to quality.This paper introduces a novel model for green supplier selection by combining traditional quality, price, delivery, and service criteria with waste management practices and circular economy principles. It assesses supplier environmental performance, resource efficiency, and sustainability. The model uses Taguchi's quadratic loss function to measure performance deviations and the TOPSIS method to prioritize criteria based on sustainability goals. This integrated approach is unique in blending traditional supply chain factors with environmental considerations, providing a more comprehensive, quantifiable way to evaluate suppliers. A case study illustrates the model's practical application, offering valuable insights for both academia and industry.*

Keywords*: TOPSIS, Taguchi's Loss Function, Circular Economy, Waste Management, Green Supply Chain Management.*

Circular economy initiatives for organic waste management in agriculture sectors in India and Vietnam – a comparative analysis

Nguyen Minh Tu[1], Nguyen Hong Quan[1,2,*], Sadhan Kumar Ghosh[3]

[1]Institute for Circular Economy Development, Vietnam National University-Ho Chi Minh City (VNU-HCM), Vietnam
[2]Institute for Environment and Resources, VNU-HCM, Vietnam
[3]Sustainable Dev. & Circular Economy Research Centre, ISWMAW & Founder Adviser, CSD&REM, Jadavpur University, India

**Corresponding Author: nh.quan@iced.org.vn*

ABSTRACT: *Waste management is one of the largest challenges facing our economy and society, driven by multiple and interconnected technical, social, and economic actors along the waste value chain. Globally, about more than two billion metric tons of municipal solid waste is generated each year. This amount is projected to increase to 3.40 billion by 2050. Vietnam produces annually almost 100 million tons of crop residues/agricultural by-products while India produces over 620 million tons of agricultural waste annually. A major portion of these are burnt in open air or disposed in landfills creating significant problem in the environment. Applying the circular economy concepts and principles in waste management is promising, since the approach could help to address multiple aspects of technical, social, and system challenges of waste generation, use and disposal. Currently, different frameworks and solutions to solve the waste problem exist in various local and global contexts. This study aims to conduct a comparative analysis of how wastes are managed and used in India and Vietnam, focusing on the organic waste management in agriculture. Various waste management frameworks and solutions in India and Vietnam are reviewed and analyzed. A synthesis framework of waste management is then developed to scale up suitable waste management pathways and lessons learned from the case studies to similar, global contexts.*

Keywords*: municipal solid waste; circular economy; frameworks; India; Vietnam.*

Zero Waste Programs in Higher Education Institutions: Understanding Factors Influencing Campus Waste Diversion and Minimization

Ashpreet Kaur*

School of Natural Resource and Environment, University of Florida

**Corresponding Author: ashpreetkaur767@gmail.com*

ABSTRACT: *generation, posing significant environmental and health risks if not properly managed. A shift towards a circular economy is essential to address the unsustainable pattern of linear consumption, and Zero Waste (ZW) supports this by aiming to divert at least 90% of waste from landfills or incineration through reduction, reuse, recycling, and composting. While many studies focus on assessing ZW programs in cities, limited attention has been given to the factors influencing the success of ZW programs in higher education institutions (HEIs). Understanding these factors is vital for reducing waste in HEIs, fostering a culture of sustainability among students, and positioning HEIs as role models for other organizations. This study uses a Delphi method, engaging 31 ZW experts, to identify the key factors that contribute to or limit the success of ZW programs in HEIs. Additionally, semi-structured interviews with 11 experts provide deeper insights into the top five factors that either support or hinder ZW initiatives in HEIs. The findings highlight state-level policies, full-time ZW staff, and consistent training, education, and outreach across campus influence the success of ZW programs. These results are further contextualized through institutional theory, where coercive isomorphism—pressure from external forces such as regulations and policy mandates—emerges as the primary driver of change in ZW practices. This theoretical framework helps explain how external pressures shape institutional behavior, offering valuable insights for improving waste reduction strategies and sustainability reporting within the HEI sector.*

Keywords*: Circular economy, Zero waste, Sustainability, Higher education institutions, waste reduction, waste diversion.*

FINISH Mondial's Approach towards Circular Economy & Innovative Financing in WASH

Kulwant Singh*

Co-Founder and CEO, 3R WASTE

**Corresponding Author: kulwantsingh2002@gmail.com*

ABSTRACT: *The session, "FINISH Mondial's Approach Towards Circular Economy & Innovative Financing in WASH," provides a comprehensive exploration of innovative financing mechanisms and circular economy models driving sustainable Water, Sanitation, and Hygiene (WASH) systems globally.*
As the moderator, I will guide the discourse through eight key presentations:

1. *Result-Based Financing in FINISH Mondial (Valentin Post, The Netherlands) – Unveiling outcome-driven funding mechanisms for scalable WASH solutions.*
2. *WASH Financing – A Global Perspective (Sarbani Bhattacharya, The Netherlands) – Discussing global trends and innovative strategies for bridging the WASH financing gap.*
3. *Climate-Smart WASH Financing (Bonani Roychowdhury, India) – Exploring financing models that integrate climate resilience into WASH systems.*
4. *Transactional Ledgers in WASH (Pamela Bundi, Kenya) – Highlighting digital tools for financial inclusion and improved sanitation investments.*
5. *Co-Compost – Its Prospects in Agriculture (Dr. R. K. Nayak, India) – Examining resource recovery opportunities in agriculture through co-compost.*
6. *Waste Service and Value Chain Competitions Changing City-Level Management (Saurabh Agnihotri, India) – Analyzing the impact of competition on urban waste management systems.*
7. *Supporting Households in Improving WASH and Rainwater Harvesting through Microfinance (Rohan Mallick, India) – Showcasing how microfinance empowers households for sustainable water and sanitation solutions.*
8. *Circularity in FSM (Abhishek Chaudhuri, India) – Promoting circularity in faecal sludge management for sustainable urban ecosystems.*

Through engaging discussions and cross-sectoral perspectives, this session will illuminate how innovative financing and circular economy practices can redefine WASH systems, creating resilient, inclusive, and sustainable communities worldwide.

Circularity in Faecal Sludge Management

Abhishek Chaudhuri*
FSMC Pvt. Ltd.
**Corresponding Author: abhishek@fsmc.co.in*

ABSTRACT: *Circularity in faecal sludge management (FSM) is emerging as a transformative approach to address global sanitation challenges while advancing sustainable development goals. By transitioning from linear waste disposal systems to circular resource recovery models, FSM not only mitigates environmental pollution but also generates valuable products such as compost, bioenergy, and treated water for reuse.This paper examines the principles and practices of circularity in FSM, highlighting its potential to create economic value and environmental benefits. It explores successful case studies where faecal sludge is repurposed into nutrient-rich co-compost for agriculture, biogas for energy generation, and safe water for non-potable applications. The integration of circular practices into FSM systems enhances sustainability by reducing dependency on synthetic fertilizers, conserving water resources, and cutting greenhouse gas emissions. Key enablers of circular FSM include robust policy frameworks, technological innovations, and multi-stakeholder collaborations involving governments, private entities, and local communities. Challenges such as public perception, regulatory hurdles, and the need for financial viability are addressed, with recommendations to scale circular FSM initiatives through capacity building, awareness campaigns, and incentives for resource recovery enterprises. By embedding circularity into faecal sludge management, this approach offers a sustainable pathway to improve sanitation services, promote resource efficiency, and support resilient urban and rural ecosystems, ultimately contributing to a cleaner and more equitable future.*

Keywords*:*

Role of Banks in Enabling Circular Economy – A Cross-Country Analysis

Kaza, Sushma*, Gupta, Kirti Divya
GITAM School of Business, GITAM University P.O., Telangana, India
**Corresponding Author: skaza@gitam.edu*

ABSTRACT: *The study undertakes a trend analysis of time series data in loans advanced by banks to the fossil financing industries/sectors, their sustainable revenue trends and finally concludes by suggesting a climate action plan framework for banks to play a vital role in enabling a circular economy. According to the 2023 report by Banking on Climate Chaos, bank funding to the oil and gas sector decreased by 9% between 2016 and 2022. Further, funding for expansion projects declined substantially by 33%. In another heartening move, fourteen of the world's biggest banks are pledging to increase support for nuclear energy. The study concludes by suggesting an action plan framework for banks to enable their circular economy role. This includes, taking action in banks transition towards green business practices; disclosure of fossil finance revenues; and measurement of sustainable revenues as a critical KPI.*

Keywords*: Fossil financing of banks, green banking, Banks and circular economy, sustainable revenues of banks, banks climate action framework*

Waste management industry's view on developing circular economy and promoting ESG principles in Kazakhstan

Vera Mustafina*
Kazakhstan Waste Management Association "KazWaste."
**Corresponding Author: veramustafina1@gmail.com*

ABSTRACT: *A circular economy is economic system which returns resources to the economic cycle in order to conserve natural resources and reduce the impact on the environment and climate. The circular economy helps to decouple economic growth from resource use. A circular economy helps achieving the sustainable development goals (SDG) and encapsulates the principles of sustainable product design, prolonged lifecycle of the products, and waste prevention and recycling. The transition towards circular economy will ensure energy-efficiency, maintain biodiversity, and create more jobs. Kazakhstan supports circular economy by having incorporated circular economy principles and SDG in The Concept for the transition of the Republic of Kazakhstan to a "green economy" and the Environment Code. KazWaste facilitates circular economy in Kazakhstan. In 2013, KazWaste created The Technical Committee (TC) 122 on circular economy, sustainable consumption and production, which is a part of the ISO/TC 323 "Circular Economy." The Committee strives to develop transparent standards, adopt best practices of ISO/TC 323, and develop international collaboration in the field of circular economy. Also, KazWaste has initiated the "Circular Economy Body" at the National ESG Club, which aims to accelerate the transition of Kazakhstan towards circular economy principles, to disseminate best practices of Kazakhstani companies within the framework of the circular economy, and to promote approaches to creating business ecosystems for the most efficient use of resources.*

Keywords*:*

IV.
Community Development & Participation

Behavioural Change and Public Awareness on usage of Social Media Marketing Strategies among SMES in KANO, Nigeria

Fatima Mahdi Shehu*
Skyline University Nigeria, Nigeria
**Corresponding Author: fmahdiprincess@yahoo.com*

ABSTRACT: *This study explores how Small and Medium Enterprises (SMEs) in Kano, Nigeria, are adopting social media marketing strategies and examines the associated behavioral changes and public awareness. In recent years, social media has become indispensable for SMEs seeking to enhance their marketing efforts due to its cost-effectiveness and extensive reach. Employing a mixed-methods approach involving qualitative interviews and quantitative surveys, the research investigates perceptions and practices among SME owners and managers in Kano. The findings highlight a noticeable shift in SME behavior towards greater utilization of social media platforms for promotional activities. Factors driving this shift include the accessibility, affordability, and potential audience reach offered by social media. However, challenges such as limited digital skills and infrastructural constraints pose barriers to optimal platform utilization. Public awareness of social media marketing benefits varies significantly among SMEs, influenced by factors such as educational background, industry sector, and business size. Keywords pivotal to this study include behavioral change, social media marketing, SMEs, Kano Nigeria, and public awareness. The study underscores the importance of targeted educational programs and improved infrastructure to maximize the advantages of social media marketing strategies among SMEs in Kano. This research provides valuable insights for both academic discourse and practical applications, offering guidance to SME operators and policymakers on effectively leveraging social media in their marketing strategies.*

Keywords*: Behavioral change, social media marketing, SMEs, Public awareness.*

Waste-To-Art Movement: A Creative Expression of Sustainability and Social Commentary in Public Places

Thangula Harish*, Lakshmi Hemantha Mallampalli
GITAM School of Architecture, GITAM Deemed to be University, Visakhapatnam, India
**Corresponding Author: hthangul@gitam.edu*

ABSTRACT: *Purpose: The Waste–to–Art Movement is a global phenomenon and trend to express the unique intersection of creativity, sustainability, and social inclusion and commentary by challenging the conventional perceptions of art and waste. Public spaces are transformed into vibrant arenas for environmental activism and dialogue, where discarded materials become symbols of both the challenges the community faces and create a shift in how the public views consumption and waste while inspiring sustainable practices. Design/methodology/approach: This paper explores the possibilities of how scrap art expression can transform discarded materials into public artworks at public spaces that not only serve as aesthetic contributions to urban landscapes but also act as a tool to communicate through powerful statements of interpretations of the public on environmental consciousness and social responsibility. Repurposing waste into art highlights the pressing issues of consumerism, pollution, and the global waste crisis. Findings: This study examines the notable case studies of waste-to-art installations in public spaces in Indian Cities to understand and analyze their impact on public perception, their role in promoting and encouraging sustainable behavior towards Waste reduction and re-use, their contribution to contemporary art and Urban living. Implications: This emerging movement can foster community engagement by involving and motivating the local population in the creative process of inclusive planning to promote a collective understanding of sustainable practices like waste as a building alternative material or plug-and-play art installation in urban beautification. Originality/value: Through this research and exploration, the Waste-to-Art Movement is strategized as a crucial cultural force, by integrating artistic expression and sensitizing the environmental advocacy in the context of modern urban living.*

Keywords*: Waste–to–Art , sustainability, social responsibility, environmental.*

From Tweets to Trades: How Social Media Shapes Financial Literacy in Today's Youth

Vanshika Thakur*, Gosala Raju
Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh, India
**Corresponding Author: vanshika.180899@gmail.com*

ABSTRACT: *In the digital age, social media platforms like Twitter, Instagram, and YouTube have played an important role in developing today's youth's financial literacy. The paper explores the impact of social media on young people's financial knowledge and habits, with an emphasis on how financial influencers and online material affect their financial decision-making. Using secondary data from academic studies, industry reports, and case studies, the study identifies both the benefits and challenges of social media-driven financial education. On the one hand, social media delivers accessible, engaging content that can improve financial literacy and encourage beneficial financial behaviors among young people. Platforms such as YouTube financial channels provide interactive and approachable financial guidance to youthful audiences. However, these advantages are balanced by disadvantages such as the spread of disinformation, the possibility of financial fraud, and a lack of legislation governing online financial advice. The study presents successful case studies in which social media has improved financial literacy, as well as examples in which erroneous information has resulted in unwise financial choices. Recommendations are made for effectively using social media to increase financial literacy while mitigating associated dangers. By encouraging collaboration with trustworthy influencers, improving regulatory monitoring, and encouraging critical thinking among users, stakeholders may leverage the power of social media to enhance financial education and empower today's youth to make informed financial decisions.*

Keywords*: Financial literacy, social media, youth, financial influencers, financial behavior.*

Corrosion and Scaling Potential of Groundwater – Implications for Handpump Maintenance

Ommi Amala[1], Kalla Vara Lakshmi[2], Anima Sunil Dadhich[1,*]
[1]Department of Chemistry, GITAM School of Science, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India
[2]Murti-Saif Facility, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: adadhich@gitam.edu*

ABSTRACT: *The maintenance and sustainability of handpumps are challenging for water distribution and regulatory bodies due to corrosion by biotic and abiotic factors. Nearly 2.2 billion people worldwide lack access to safely managed drinking water. Sustainable Development Goal 6 (SDG 6) on water, adopted by the United Nations at the UN Summit 2015 as part of the 2030 Agenda, provides the blueprint for ensuring water availability and sustainable management. Groundwater samples are collected from handpumps located in selected areas of the Visakhapatnam district to estimate corrosion tendency and scaling potential. The water supply distribution systems are impacted by the quality of groundwater supplies, which are also highly susceptible to scaling tendency and corrosion potential. The purpose of the scale is to create an obstacle between the surface of the pipe and groundwater to inhibit corrosion. Physicochemical analysis was conducted for groundwater samples collected using the standards adopted by the American Public Health Association (APHA 1999). Water quality parameters such as pH, Electrical Conductivity (EC), TDS (Total Dissolved Solids), Total Hardness (TH), Total Alkalinity (TA) with major anions (F-, Cl-, Br-, NO3-, PO4-3 & SO4-2) and cations (K+, Na+2, Ca+2 & Mg+2) were analyzed by standard protocols and compared with Bureau of Indian Standards (BIS 10500:2012). The results obtained from the physicochemical parameters were used to calculate the corrosion tendency and scaling potential, such as Langelier Saturation Index (LSI), Aggressive Index (AI), Ryznar Stability Index (RSI), Puckorius Saturation Index (PSI) and Larson-Skold Index (L-S). Microorganisms like the Leptothrix genus were isolated from collected groundwater samples using specific and differential media for isolating Iron oxidizing bacteria (FeOB). The Ferro/Ferric cyanide test evaluated the isolated organism's ability to oxidize Fe+2 to Fe+3. In general, groundwater collected from the sampling areas has shown possible corrosion capacity, which affects the domestic, industrial, and water distribution networks and has a higher chance of deteriorating soon.*

Free Electricity Programme and Farmer's Attitude; A Study from Telangana State of India

Mohammed Shameem P[1,2,*], Krishna Reddy Chittedi[1]

[1]School of Economics, University of Hyderabad, Hyderabad, India

[2]GITAM School of Business, GITAM University, Bengaluru, India

**Corresponding Author: mohammedshameemp@gmail.com*

ABSTRACT: *The preconceived notions on Indian farmers' attitudes towards the habituated production input subsidies are revisited. The 24-hour free electricity program in Telangana state of Southern India is analysed from the perspective of farmers at the receiving end. The study is based on a field survey conducted in the Nalgonda district of the state after the completion of three years of the program. The primary survey result shows that farmers are driven by the promises of the government of free electricity supply and replacing their automatic motor pumps with manual motor pumps. The farmers' attitude and consumption behavior of free electricity endorses the success of government awareness drives and the possible sustainability of the program in the state in which they are satisfied. Even after three years of the program, the prevalence of motor pumps with the power of 5 HP and usage for 6 hours or less inscribes the sensibility of farmers in Telangana state. The willingness to accept usage-based tariffs and concern for electricity conservation in the absence of any incentive indicates a drastic change in the attitude of Indian farmers towards freebies.*

Keywords*: Freebies, Indian farmers, Subsidies, Primary survey, Telangana, JEL codes: Q1, Q4, R5, H7.*

Advancements in Nanocellulose Derived from Plant Biomass: A Sustainable Solution for Enhanced Wastewater Treatment

Lopamudra Digal, Dilip Kumar Kar, Jayashree Mohanty*

Department of Chemistry, C.V. Raman Global University, India

**Corresponding Author:*

ABSTRACT: *Nanocellulose, derived from plant biomass, has emerged as a promising material for sustainable wastewater treatment, owing to its exceptional surface area, high mechanical strength, and tunable surface chemistry. Nanocellulose, including cellulose nanocrystals (CNCs) and cellulose nanofibrils (CNFs), is extracted through mechanical, chemical, and enzymatic processes. These nanomaterials exhibit exceptional surface area, high mechanical strength, and tunable surface chemistry, making them ideal candidates for adsorbing pollutants. Extraction techniques encompass mechanical, chemical, and enzymatic processes, yielding nanomaterials with abundant hydroxyl groups suitable for pollutant adsorption. The functionalization of nanocellulose enhances its adsorption capacity and selectivity, enabling effective removal of diverse contaminants such as heavy metals, dyes, and organic compounds. Recent advancements highlight the superior performance of modified nanocellulose-based adsorbents, hybrid materials, and nanocomposites over conventional treatment methods. Case studies underscore the scalability and integration potential of nanocellulose in real-world wastewater treatment infrastructures. Despite its biodegradability and non-toxic nature, challenges persist in cost-effective large-scale production, regeneration, and reusability of nanocellulose adsorbents. This review systematically examines various preparation techniques for nanocellulose, including mechanical, chemical, and enzymatic methods. It also explores the properties of cellulose nanocrystals (CNCs) and cellulose nanofibrils (CNFs) and their modifications for enhanced performance in wastewater treatment. It identifies key research gaps and future directions, underscoring the importance of interdisciplinary approaches to fully exploit nanocellulose's capabilities in global water pollution mitigation.*

Keywords*: Nanocellulose, biomass, water treatment.*

Commuting Green, Riding for Well-Being: Analysis of Environmental Identity and Well-Being on Commuting

Abhishek Saikia*, Rahmath Nishada. K, Guneet Inder Jit Kaur
Dept. of Sports Psychology, School of Sports Sciences, Central University of Rajasthan, India
**Corresponding Author: abhi1999sai@gmail.com*

ABSTRACT: *The study titled "Commuting Green, Riding for Well-Being: Analysis of Environmental Identity and Well-Being on Commuting" investigates the relationship between environmental identity (EID) and overall well-being among athletes involved in Mountain Biking and Cycling. This research aims to understand how strongly an athlete's identification with environmental values (EID) influences their psychological well-being, particularly in the context of eco-friendly commuting. The study analyzed a sample of 30 international, national, and state-level athletes using correlational methods to explore this dynamic. The results indicate a significant positive correlation between Environmental Identity and overall well-being ($r = 0.694$, $p < 0.01$), suggesting that athletes with a stronger environmental identity tend to experience higher levels of well-being. Additionally, the study explores the relationship between commuting variables such as duration and distance with well-being, finding a significant negative correlation between commute duration and well-being ($r = -0.377$, $p < 0.05$). This implies that longer commutes are associated with lower well-being, potentially due to physical fatigue, stress, and reduced time for personal activities. However, no significant correlations were found between Environmental Identity and commuting duration or distance, indicating that the positive impact of Environmental Identity on well-being is not directly related to these commuting factors. These findings underscore the importance of fostering a strong environmental identity as a potential pathway to enhance well-being, particularly for athletes engaged in green commuting practices. The study concludes with recommendations for future research to further explore these relationships and to develop interventions aimed at improving well-being through enhanced environmental identity and sustainable commuting behaviours.*

Keywords*: Well-Being, Environmental Identity, Commuting.*

Promoting diversity, equity, and inclusion in academic institutions: an exploration and outlook on Academic Performance

Sujit Kumar Patra[1,*], Sunil Kumar[2]
[1]Jaipuria Institute of Management, Lucknow, India
[2]Gitam School of Business, India
**Corresponding Author: sujit.patra@jaipuria.ac.in*

ABSTRACT: *Academic institutions nationwide are increasingly recognizing the importance of fostering inclusion, equity, and diversity. Both faculty and students are affected by these efforts within academic settings. However, departments lacking established avenues for such initiatives may face challenges in knowing where to begin. The paper outlines a process for establishing a committee dedicated to supporting DEI initiatives at the institutional level within universities. Additionally, the authors present a theoretical framework for understanding DEI within higher education. The current paper identifies lessons learned regarding the barriers and facilitators to academic success at the institutional level. This research investigates the influence of diversity, equity, and inclusion (DEI) on academic achievement, using a sample of 378 participants from academic institutions. Analysis of the study was conducted using software like SPSS and Smart-PLS. The findings underscore the significant impact of DEI on academic performance. These results can guide government agencies and educational institutions in advancing DEI initiatives.*

Keywords*: DEI, Academic Institutions, Performance, Regression, India*

Hitching Up Intention to Engage towards Adoption Behavior for Sustainable Daily Lifestyle Practices among Gen-Z

Sowmiya S[1,*], A. Bharathy[2]

[1]Department of Management Studies Pondicherry University Kalapet, India
[2]Department of Management Studies Pondicherry University Community College, Lawspet, India

**Corresponding Author: sowmiyasekar215@pondiuni.ac.in*

ABSTRACT: *Over the past decade many countries including India have witnessed more frequent and severe weather events, such as the devastating floods, intense heat waves that have become increasingly common. While increasing ecological crisis and the urgent need for sustainability practices in daily life, particularly among young generations in their consumption choices and waste management have significant global implications, making individual practices crucial in the fight against climate change. Further contemporary discourse on sustainability has increasingly focused on the behaviours and attitudes of Gen Z, individuals born between 1997 and 2002, who are emerging as significant drivers of social change. The aim of the present study is to meet the needs of the present without compromising the ability of future generations to meet their own needs. The study explores the effect of the predictors of perceived value (green attitude, subjective norms and promotional messages) and intention to follow sustainable daily lifestyle practices (SDLP) on adoption of SDLP among Gen Z audience. The research results based on hierarchical multiple regression analysis hitches up the dominant predicting effect of subjective norms engagement on the intention and adoption behaviour of Sustainable Daily Lifestyle Practices as identified by the Theory of Planned Behaviour Model.*

Keywords*: Green Attitude, Subjective Norms, Perceived Value, Intention to Adopt, Adoption of Sustainable Daily Lifestyle Practices*

Influencing Factors for Locality Options in Case of Affordable Housing in an Urban Sprawl at Cost in an upcoming Urban Capital Region

Abhishek Kumar Singh[*], Professor Subba Rao

Gitam School of Architecture, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: asingh@gitam.edu*

ABSTRACT: *This is ultimately made more complex by the unequal spatial distribution of economic activity, which makes house prices (and consequently capital values) the most significant determinant of spatial differentiation in residential yields. Sociocultural factors sometimes underplayed or disregarded in the Indian context can be a matter of life and death. They should be at least as necessary, if not more so, than economic return. Though it is essential, human sociocultural ties and the benefits of the potential for increased survival rates and sustainability are generally not considered when selecting locations. In most connected cities, unique ethnic and cultural identities form neighbourhoods where typically good people prefer their kind. This study explores the various factors affecting property prices and rents, especially sociocultural aspects. Activities may include learning theoretical principles and testing their impacts by weighting fieldwork and spatial analysis with numerical values to model the urban growth case studies. The study also includes primary and secondary sources, and a critical review of the literature is conducted because of the nature of the research. This first survey collects residents' thoughts concerning attributes of their communities, including pros and cons. The secondary survey bears the top methodologies possible. Principally, literature reviews about physiological, environmental and biomedical matters alongside other mechanisms. This means that the study explicitly considers all affordability dimensions, emphasising how sociocultural influences frame housing costs and choices. The house type area was subdivided into ranges for analysis. Each factor was scored, weighted, and compared. The final part of the study interprets the results, focusing on factor weightage related to price changes and hypertrophicization in housing sectors.*

Keywords*: Spatial differentiation, Residential building.*

Sustainable Entrepreneurship through Cooperatives: A Way Ahead

Prashant V Kadam*
India
**Corresponding Author: kadam_prashant@live.com*

ABSTRACT: *Sustainable entrepreneurship has become a vital route for attaining long-term economic stability and ecological balance in the face of growing environmental and social concerns. Cooperatives offer an appealing paradigm for promoting sustainable business because of their distinctive structure and operational characteristics. its values and principles synergises and promotes innovation, equity, and environmental stewardship, The article examines the synergy between cooperative principles and sustainable business practices. By thoroughly examining case studies and theoretical frameworks, it demonstrates how cooperatives can help achieve the Sustainable Development Goals (SDGs) and offer tactics to increase their influence.*

Keywords*: Sustainable Entrepreneurship, Cooperatives, Sustainable Development Goals, Innovation, Equity, Environmental Stewardship.*

Innovative Models in Social Entrepreneurship: Exploring the Role of Technology in Scaling Social Impact

Sunil Kumar*, Priyanka
Alliance School of Economics, Alliance University, Bengaluru, India
**Corresponding Author: sunil.kumar@alliance.edu.in*

ABSTRACT: *In the fast changing space of social entrepreneurship, it is instrumental that change-making models are created to scale impact efficiently. This paper explores the confluence of technology and social entrepreneurship, spotlighting ways in which digital technologies benefit expandability most visibly among ventures with a purpose-serving orientation. We explore the technology landscape for social enterprises with examples from different topologies and frameworks, focusing on defining the tools such as digital platforms, data/analytics capabilities or mobile applications that have enabled these entities to create value by enhancing their reach, penetration or impact. The paper illustrates how such tools help social entrepreneurs to respond permissive constraints (such as resource constraint and boundary optimal) through scalable solutions; and in the operational context, faster real-time data driven decision making. And, we discuss the potential impact of emerging technologies such as block chain and AI on institutional transparency, accountability and inventiveness in service delivery. Integration of technology into social entrepreneurship strategies, amplify the reach and effectiveness social innovations while also contributing more systemically by responding averagely to intricate societal issues. The paper closes by describing a social entrepreneur-friendly model of technology use, suggesting that tech stakeholders as well must be adaptive in their approach and develop more 'social entrepreneurship literacy' to ensure better outcomes for society.*

Keywords*: Social Entrepreneurship, Technology, Innovation, Scaling Social Impact, Digital Mobile Applications, Systemic Change*

Hidden Hazards: Unveiling the Occupational Health Risks in selected Hospitals of Patna Municipality - A Comparative Insight through Failure Mode and Effect Analysis

Abhijeet Kumar, Firdaus Fatima Rizvi
Central University of South Bihar, Gaya, Bihar, India
**Corresponding Author: abhijeet.k3196@gmail.com*

ABSTRACT: *Prevention and control of communicable and non-communicable diseases require comprehensive healthcare. Due to rapid urbanization, population growth, and healthcare expansion, Patna has biological waste management concerns. Biomedical waste (BMW) management in the healthcare industry is complex, especially due to occupational health dangers. Neglecting management and disposal can spread contagious illnesses, toxins, and other health problems. Objective: This study evaluates the disposal processes of BMW and also the occupational health risks associated with waste workers in public and private hospitals in Patna, using the Failure Mode and Effect Analysis (FMEA) approach. Method: This research included field observations and questionnaires provided to waste handlers at 12 healthcare facilities in 2 Circles of Patna Municipality. Six of the twelve hospitals are public, while six are private with different bed capacity. The FMEA framework was used to evaluate various failure possibilities. Result: The study found that public and private hospitals have BMW management issues with varied risk level. It has been observed that poor infrastructure, finance, and oversight increase RPNs in public hospitals is raising occupational health risks. Despite being more prepared, private hospitals lack training and protective gear efficiency. Conclusion: To promote safer garbage disposal, this study recommends tougher regulatory enforcement, better training, and budget allocation. Healthcare institutions can reduce occupational health hazards, eliminate potential failure points, and improve BMW management by using FMEA.*

Keywords*: Health Care service, Public health facilities, Biomedical waste Management, FMEA, Occupational Health Risk.*

Consumer Intention towards Electric Vehicles for Tourism

Meghna Aggarwal[1], Tushar Batra[2,*]
[1]Amardeep Singh Shergill Memorial College, Mukandpur. Distt SBS Nagar (A University College of GNDU, Amritsar), India
[2]Khalsa college, Amritsar, India
**Corresponding Author: tusharbatra01@yahoo.com*

ABSTRACT: *This study investigates consumer intentions on the use of electric vehicles (EVs) in the tourism industry, with a focus on how environmental awareness, financial gains, and technological improvements are driving this trend. Due to their smaller carbon footprint, EVs are becoming more and more popular among travellers who are becoming more conscious about the environment. Convenience and accessibility issues have been addressed by EVs' improved range and growing charging infrastructure. Their appeal is further increased by economic reasons like lower operational costs and tax incentives. This change is also influenced by the allure of cutting-edge technology and the quest for uncommon travel experiences. Adoption rates vary depending on local infrastructure, governmental regulations, and the perceived dependability of EVs despite these encouraging developments. The study's overall findings demonstrate a noteworthy upward trend in the use of electric vehicles in tourism, which is indicative of a larger social commitment to environmental responsibility and innovative transportation.*

Keywords*: Consumer Intention, Electric Vehicles, Tourism, Social Commitment, Technological*

Social Entrepreneurship in India: A Catalyst for Social Change

Lingam Sampath*
India
**Corresponding Author: lsp5683@gmail.com*

ABSTRACT: *Over the past few decades, social entrepreneurship in India has evolved as a major sector to stimulate large scale infinitives across critical issues like poverty alleviation, rural development & economic empowerment of women. The paper covers a detailed analysis of the evolving landscape of social entrepreneurship in India, focusing on expansion & maturation (quantity and coverage), challenges faced by SEs diversity/vibrancy framework -sectorial distribution, regional context-breadth vs. depth) and financial figures. The study outlines that the majority of social entrepreneurs operate in sectors such as education, healthcare, renewable energy and agriculture which present distinct roadblocks — ranging from access to finance and regulatory challenges; need for scalability within markets; difficulty acquiring talent. The research outlines the most critical sources of funding to date – particularly impact investors, but also government schemes and corporate social responsibility (CSR) efforts with significant regional variations in how different parts are getting funded. The South and West regions top the chart with respect to total funding due to a larger share of social enterprises from healthcare, technology etc in these regions. The research also takes a deep dive into the gender breakdown of social enterprise founders, highlighting how women and non-binary people are becoming more involved — though there is still some way to go. The paper also offers lessons regarding what social enterprises are measuring and over which timeframes, revealing the importance of accountability as well as transparency in enforcing outcomes driven by a broader set of societal imperatives. This also includes sector specific challenges such as the high capital cost burden which is most relevant to an industry like renewable energy or issues around market linkages that are most critical in agriculture, and therefore underscores necessity of policy direction along with ecosystem support.In summary this research paper has highlighted how social entrepreneurship contributes significantly to inclusive and sustainable development in India. It will require a new relationship to be established between the various actors—government, private sector, investors and civil society—to create an environment that nurtures social enterprises from start-up through scaling. The findings would be of much use to policymakers, practitioners and researchers working on leveraging social entrepreneurship as a change-agent for transforming India.*

Keywords*: Social Entrepreneurship, Social Impact, Sustainable Development, Funding Sources, Sectoral Distribution.*

Strategic HR Practices, Employee Agility and Organizational Adaptability: A Study on Indian Oil Refineries

MVM Nagendra*, Potnuru Rama Krishna Gupta
GITAM University, India
**Corresponding Author: nmukku@gitam.in*

ABSTRACT: *Abstract Purpose– The purpose of this study is to investigate how strategic human resource management and employee agility impacts organizational adaptability in the Indian oil refineries. Design/methodology/approach– A convenience sampling technique is used to collect primary data from employees in various refineries from both public and private sectors in India. The study has performed confirmatory factor analysis in AMOS 22 to validate the study variable, and conducted covariance-based structural equation modelling to test the study hypotheses. Findings– Results revealed that both SHRM and employee agility are positively related to organizational adaptability. Employee agility mediates the relation between SHRM and organizational adaptability. Flexible SHRM practices shown to further strengthen the agility and adaptability within an organization. Originality/value– Organizational adaptability is an important/vital aspect when it comes to refineries operations in view of the volatile marketing atmosphere. Although researchers have acknowledged several antecedents of adaptability, it is still unclear how strategic orientation influences organizational adaptability. Addressing this gap, the present study specifically focuses on understanding the importance of aligning SHRM practices with employee agility to achieve organizational adaptability.*

Keywords*: Adaptability, Employee agility (EA), strategic human resource management (SHRM)*

Reverse Logistics in the E-commerce Industry: Challenges and Opportunities

A. Amirtha*
Department of Management, Rathinam College of Arts & Science, Coimbatore, India
**Corresponding Author: amirthamuthuvelavan@gmail.com*

ABSTRACT: *The rapid expansion of the e-commerce industry has dramatically increased product returns, elevating reverse logistics to a critical component of modern supply chains. This seminar examines the challenges and opportunities of reverse logistics in e-commerce, with a focus on high-return sectors such as fashion, electronics, and consumer goods. It delves into the complexities of managing returns, including restocking, refurbishing, disposal, and redistribution, while balancing customer satisfaction and operational efficiency. Key challenges such as high return rates, rising operational costs, complex inventory management, and the environmental consequences of reverse logistics are critically analysed. The seminar also discusses the financial burden posed by free return policies, customer expectations for seamless returns, and the logistical hurdles associated with cross-border e-commerce. On the environmental side, the seminar addresses the growing concerns over increased carbon emissions and landfill waste from product returns and explores strategies for minimizing the environmental footprint. Furthermore, the seminar explores reverse logistics' potential to support sustainability objectives by reducing waste, encouraging product reuse, and contributing to a circular economy. The integration of reverse logistics into corporate social responsibility (CSR) initiatives is also analysed, including how companies can enhance their brand reputation by adopting eco-friendly return practices. Case studies from leading e-commerce companies such as Amazon, Walmart, and Calando are presented to showcase innovative reverse logistics strategies and best practices. These examples illustrate how companies are overcoming challenges, leveraging technology, and embracing sustainability to turn reverse logistics from a cost center into a strategic advantage.*

Keywords*: 1. Reverse Logistics 2, E-commerce Returns, 3. Circular Economy, 4. Sustainability, 5. Product Lifecycle Management, 6. Automation and AI, 7. Cost Management, 8. Customer Satisfaction.*

Challenges, Opportunities & Prospects of Green Chemistry in Industrial Application

Priyanka Thorat*
India
**Corresponding Author: pratikshapri@gmail.com*

ABSTRACT: *The Chemical Industry is one of the booming sectors. It is a diversified sector contributing a good fraction to the Indian economy. In the manufacturing and production process, one of the major issues faced by chemical industries involves the disposal of elimination and reducing chemical waste including hazardous possibly eco-friendly ways. Green chemistry is one of the most explored days as it aims to reduce and eradicate the production of harmful by-products in an eco-friendly way. Green chemistry helps to eliminate the use or production of substances that are not safe. Thus, it assists in minimizing the risk to the environment, and biodiversity, reducing health hazards, reducing waste, and lowering chemical eruption in an environmentally friendly way this paper throws a light on sustainable manufacturing strategy by utilizing green chemistry for designing safer non-hazardous chemical waste. It explores various examples in which green chemistry has boosted the sustainability factor of industrial processes enormously and suggests multiple measures that should be taken to help as well as promote green practices in synthesis.*

Keywords*: Green Chemistry, sustainable development, new technology. Waste management & recycling.*

Marketing Challenges and Consumers Purchasing Behaviour towards Anil Food Products

Y. Prabhakar, R. Prabusankar*

GRG School of Management Studies PSGR Krishnammal College for Women Coimbatore, Tamil Nadu, India

**Corresponding Author: yprabakar@gmail.com*

ABSTRACT: *Marketing is an essential component in the food and beverage industry. It aids companies in attracting and retaining customers, boosting sales, and enhancing brand growth. Brand awareness and customer loyalty are fostered through marketing, which is crucial for the food and beverage sector. A robust marketing strategy can help a company differentiate itself from competitors and establish a strong bond with its target audience. Consequently, this can result in increased sales and customer loyalty, as individuals are more inclined to patronize a brand they trust and are familiar with. Additionally, marketing plays a vital role in introducing new products and special promotions. This can entice new customers and drive sales by encouraging individuals to try something different. Furthermore, marketing is instrumental in cultivating relationships with suppliers and partners. By collaborating closely with suppliers and partners, businesses in the food and beverage industry can secure access to top-quality ingredients and products. This is particularly significant for companies that rely on seasonal ingredients or have limited supplies of certain products. The objective of this study is to examine and ascertain the influence of marketing on consumer purchasing decisions, as well as how marketing aids consumers in making purchasing decisions. The research primarily focuses on Anil's food products and the purchasing behaviour of consumers. A descriptive research design was employed in this study, with a sample size of 215 customers. Stratified sampling technique was utilized for the research. Data was gathered through a structured questionnaire and analysed using Excel and various statistical tools. The findings were derived from the data analysis, and relevant recommendations were provided.*

Keywords*: Purchase, Food, Products, Customer.*

A Study on Digital Marketing and its usefulness in Effective Business

Shivaji T Mane[1,*], Ritesh Gholap[2]

[1]Dr. D.Y. Patil Institute of Management Studies, Pune, India

[2]KBC North Maharashtra University, Jalgaon, India

**Corresponding Author: shivaji.mn@gmail.com*

ABSTRACT: *This research paper, titled "A Study on Digital Marketing and its Usefulness in Effective Business," investigates the role and effectiveness of digital marketing in contemporary business practices. The study aims to explore effective digital activities in B2B marketing, evaluate digital marketing strategies for micro, small, and medium enterprises (MSMEs) in the National Capital Region (NCR), and assess the impact of online marketing strategies on business outcomes. Using secondary data and a comprehensive literature review, this research identifies key digital marketing activities that contribute to successful B2B engagements, highlights the unique challenges and opportunities faced by MSMEs in adopting digital marketing strategies, and examines the broader implications of online marketing tactics on business performance. The findings provide valuable insights for businesses seeking to optimize their digital marketing efforts and suggest future research directions to further understand the evolving landscape of digital marketing.*

Keywords*: Digital Marketing, B2B Marketing, MSMEs, Online Marketing Strategies, National Capital Region (NCR), Business Performance, Secondary Data, Literature Review, Marketing Effectiveness.*

Towards Zero Waste: Building a Community-Based Model in Magalang, Pampanga, Philippines

Maria Cristina V. David[1], Mari Rowena C. Tanquilut[2,*], Rizza G. Baltazar[3], Romana B. Pare[3], Madeliene R. Solis[1], Lyndon G. Solis[1]

[1]Department of Civil Engineering, College of Engineering and Computer Studies (CoECS), Pampanga State Agricultural University (PSAU). Philippines
[2]Department of Agricultural and Biosystems Engineering, CoECS, PSAU, Philippines
[3]Department of Computer Studies, CoECS, PSAU, Philippines
**Corresponding Author: rowena@psau.edu.ph*

ABSTRACT: *Effective solid waste management is essential for environmental sustainability. To achieve this, key strategies and technologies including resilient recycling programs, eco-friendly disposal methods, and public awareness to promote responsible waste practices should be implemented. By adopting comprehensive systems, communities can protect the environment and promote a recycling economy. The School-based Solid Waste Management (SWM) Extension project aims to educate students on waste segregation, recycling, and composting, establishing school waste management systems and extending these practices to nearby communities to ground break an impactful intervention. The project achieved three major outcomes, namely: a) 70% increase in waste segregation; b) 100% rise in recycling and composting rates; and c) significant positive behavioral change among students, teachers, and the local community. These efforts helped divert large amounts of wastes from open dumpsites, fostering a stronger sense of environmental responsibility at school and at home. This model may serve as a blueprint for other communities aiming to implement similar waste reduction initiatives towards zero waste. Challenges included limited infrastructure for proper waste disposal and recycling, financial constraints, and difficulties in encouraging behavioral change. Despite these hurdles, the project successfully laid the groundwork for sustainable waste management practices within schools and communities. This project made significant strides in promoting sustainable waste management practices among schools and communities. Through continued collaboration and education, the project was able to lay down a good foundation to reduce the environmental impact of solid wastes, contributing to a cleaner and more sustainable future.*

Keywords*: Zero waste, solid waste management, waste audit, waste recycling.*

EnviroScan: Community and NGO Waste Solution

Rupali Soni*, Bhagyashree Vaswani, Chandni Gangwani, Shamal Dhekale

Computer Department, Vivekanand Education Society's Institute of Technology, Mumbai, India
**Corresponding Author: rupali.hande@ves.ac.in*

ABSTRACT: *Waste, particularly plastic waste, poses a major challenge to environmental sustainability, overwhelming current management systems. The integration of advanced object detection technology offers a solution by accurately detecting and quantifying plastic waste from community-reported videos or photos of dumpsters. This data-driven approach enables NGOs to optimize resource allocation for waste collection and segregation, significantly improving efficiency and reducing operational bottlenecks. Additionally, the system promotes environmental engagement through features such as event announcements, educational content, and sustainability news, encouraging active community participation. Key findings highlight improvements in NGO operations, reduced waste collection times, and increased community involvement in sustainability efforts. The implications of this technology extend to scalable solutions for both urban and rural waste management, offering an innovative approach to addressing plastic waste challenges. By merging machine learning with community action, this solution bridges the gap between technology and environmental stewardship, empowering both NGOs and communities to work collaboratively towards effective waste management.*

Keywords*: Waste Management, Plastic Waste, Object Detection, Community Engagement, Sustainability Practices.*

Web Based Landslide Early Warning System using Wireless Sensor Networks

Roshan Shetty[1,*], Amarnath Shetty[2]

[1]Department of ECE, Alva's Institute of Engineering & Technology, Moodbidri, India

[2]Department of Civil Engineering, A.J Institute of Engineering & Technology, Mangalore, India

**Corresponding Author: roshan564956@gmail.com*

ABSTRACT: *Though landslides are a naturally occurring environmental hazard, but nowadays they have increased relatively. This problem cannot be prevented, but losses can be minimized by an early warning system using wireless sensor networks. Early warning system mainly depends on a remote wireless sensors installed in landslide prone hilly areas. The sensors are installed to sense the changes in soil conditions, rainfall behavior, and soil movement. The main aim of the proposed system is to detect these changes and notify general public well in advance. The sensors are interfaced with Node MCU ESP8266 microcontroller wirelessly to process data. The processed data are transmitted to server through HTTP protocol, where localhost web page displays the present status. Early warning alerts are transmitted to local public through GSM messages. The proposed web-based interface makes it simple for operator to control and modify settings in accordance with area and weather profiles. This quick detection and early warning can safeguard many lives.*

Keywords*: Landslide, WSN, NodeMCU, Arduino UNO, Environmental Sensors.*

Dendrochronology and its Application in the Age Assessment of Abies Spectabilis from Uttarakhand Western Himalaya

Mohd Ajmal Khan*

Integral University, Lucknow, UP, India

**Corresponding Author: aliajmalkhan1998@gmail.com*

ABSTRACT: *Background of Dendrochronology: Dendrochronology is the study of annual tree ring growth. Yearly ring growth is related to both external resources and conditions in the tree. External factors include water, temperature, light, carbon dioxide, oxygen and soil minerals, which affect temperature, water availability, and carbon building materials within trees. Therefore the availability of resources for growth depends on climate, site, and stand conditions as well as genetics. One aspect of dendrochronology, dendroclimatology, relates differences in yearly growth to climatic factors in order to improve understanding of the past, present, and future relationship between climate and tree growth. In India tree-ring analysis has a vast scope for c1imatic studies. Due to its latitudinal and altitudinal ranges a variety of micro-c1imates and in consequence a diversity of forest types from tropical to alpine have to be taken into account (Champion & Seth 1968). Since long many tree species of these forests are known to produce annual rings (Gamble 1902), but systematic dendroc1imatic studies have only been performed since the end of the 1970s (Pant 1979; Pant & Borgaonkar 1984; Ramesh et al. 1985, 1986; Pant et al. 1992, 1995; Bhattacharyya et al. 1988, 1992a, b; Bhattacharyya & Yadav 1990, 1992, 1996; Yadav & Bhattacharyya 1992; Borgaonkar et al. 1994, 1999). In this paper dendroc1imatic reconstructions for both Himalayan and tropical forest sites of India will be discussed.*

Keywords*:*

Navigating Green Consumption: Unveiling the Drivers of Eco-Friendly Purchases in the Digital Age

Mohammed Nazish*
Department of Business Administration, Aligarh Muslim University, Aligarh, India
**Corresponding Author: Nazishamu65@gmail.com*

ABSTRACT: *Purpose: The deteriorating environment necessitates immediate remedial measures to preserve life forms in their natural state. The depleting environment poses a threat to the sustainability of present and future generations. There is an urgent need to regulate anthropogenic activities. This scholarly work examined the factors that lead to environmentally friendly consumption among consumers. We extended the TPB model with additional variables, namely social media marketing (SMM) and environmental concern (EC) to investigate consumers' green consumption behavior. Methodology: Data were collected from 388 respondents residing in Delhi, India. The obtained data were analyzed using the PLS-SEM technique. Findings: The results indicated that social media marketing, environmental concerns, subjective norms, perceived behavioral control, and attitude towards green products all positively influence green purchase intention. Implications: Finally, the study discusses how social media can be used to promote green lifestyles and products and outlines several strategies for marketers to promote green initiatives. Originality/value: The literature in the context of social media affecting green preferences is limited in the Indian context. Our study is among the few investigations that studied the impact of social media marketing on consumers' green purchase intention.*

Keywords*:*

Occupational Health and Safety of Waste Workers: A Case Study in Chattogram City of Bangladesh

Md. Ajijur Rahman, Mst. Farzana Rahman Zuthi*, Tanveer Bin Fakhrul, Md. Jakaria Alam
Department of Civil Engineering, Chittagong University of Engineering and Technology, Bangladesh
**Corresponding Author: farzana@cuet.ac.bd*

ABSTRACT: *The study investigates the occupational health and safety (OHS) challenges of waste workers in Chattogram City, Bangladesh, highlighting their socio-demographic characteristics, chronic health conditions, hygiene practices, and access to training and financial support. This study used a mixed methods approach to evaluate different aspects of occupational health and safety practices thoroughly. It included semi-structured interviews with randomly selected workers from various occupations, such as sanitary pit collectors and road sweepers. Additionally, social surveys were conducted with workers to understand their OHS knowledge, attitudes, and practices, including using personal protective equipment (PPE), hygiene habits, and behavior related to seeking treatment. The prevalence of chronic diseases among waste workers includes muscle pain (64.0%), back pain (46.3%), and asthma (22.2%). Despite the established link, only 18% of workers received any Occupational Health and Safety (OHS) training despite the considerable health risks. In addition to these health concerns, there is a lack of easy access to hygiene and financial assistance. The study observed significant associations between occupation and asthma, consistent with earlier research on factors associated with cardio-respiratory fitness. The study revealed poor hygiene practices among workers and highlighted challenges faced by women waste workers, including discrimination and lack of childcare services. It emphasizes the need for specific policies and interventions in waste management. The findings will provide valuable insights for policymakers, employers, and civil society organizations to protect the health and rights of waste and sanitation workers in Bangladesh. This study also calls for immediate attention to improve their living conditions, healthcare accessibility, and overall livelihood.*

Keywords*: Occupational health and safety, chronic diseases, hygiene practices, waste worker.*

Designing for Comfort and Dignity: Investigating Evidence-Based Design Principles in Palliative Care Spaces for Terminally Ill Adolescents

R.S. Aruna[1], Shanta Pragyan Dash[1], Dibya Jivan Pati[2,*]

[1]Manipal School of Architecture and Planning, MAHE, Manipal, Karnataka, India
[2]School of Architecture, GITAM Deemed to be University, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: aruna.r1@learner.manipal.edu*

ABSTRACT: *Purpose: The design of Palliative care environments for terminally ill adolescents presents unique challenges and opportunities, requiring a sensitive and holistic approach to address the complex needs of this vulnerable population. This study explores the intersection of architecture and palliative care, focusing on creating spaces that enhance the quality of life, dignity, and well-being of AYAs (Adolescents and Young Adults) facing terminal illnesses. Through an in-depth examination of existing literature, case studies, and empirical research, this study identifies key design principles, models, and frameworks that inform the creation of therapeutic and supportive palliative care environments. Design approach: Central to this research is the exploration and application of Evidence-Based design (EBD) principles, emphasising the importance of empirical data, case studies and user-centred approaches in shaping healthcare spaces. This research article also considers the Psychosocial Model of care, neuroarchitecture, sensory design, trauma-informed design, and universal design, integrating these frameworks to create comprehensive and inclusive environments tailored to the needs of adolescents. This research seeks to determine the essential elements for improving end-of-life care for terminally ill adolescents. By examining successful literature and data, the study aims to identify criteria that contribute to healing, comfort, and resilience, ultimately enhancing the quality of life for both adolescents and their families. Factors such as privacy, autonomy, personalized design, sensory considerations, social support spaces, and accessibility are considered to create environments that prioritize the psychological, psychosocial, and physical needs of adolescent patients. Findings: Nature integration, Activity spaces for peer interaction and Accessibility are the most important criteria that need to be considered to enhance the psychological and psychosocial well-being of terminally ill adolescents in hospices. Originality/value: This study contributes to the existing literature on healthcare architecture and emphasizes the significance of interdisciplinary collaboration in designing palliative care environments that are compassionate, inclusive, and tailored to the specific, unique needs of terminally ill adolescents.*

Keywords*: Palliative Care, Psychosocial support, Transitional spaces, Adolescents, Comfort.*

Enhancing Training Awareness on Biodegradable Waste Management Practices – A Study on MARIDI Eco Industries, Visakhapatnam

Sireesha Rani. Vasa*, T Sowdamini

GITAM (Deemed to be) University, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: svasa@gitam.edu*

ABSTRACT: *The alarming rise in biodegradable waste generation poses significant environmental and health concerns in urban India. Hospitals are decisive in employing skilled workers to manage biomedical waste sustainably. A skilled workforce is essential for adequately disposing of hazardous waste, where attention can be drawn towards workforce development and training in biomedical waste management to ensure compliance with the regulations of standards. Practical stakeholder training and awareness are crucial for implementing sustainable waste management practices. MARIDI Eco Industries, one of the key pioneers in Visakhapatnam, has been instrumental in addressing and improving this condition—the emission of healthcare biomedical waste in and around all the hospitals, majorly in promising sustainability. A pilot study was done among 12 hospitals in Visakhapatnam, where it was identified that the biomedical waste segregation and recycling process had been given a minimal concentration. As highlighted by the company, phase-wise processing has become a significant constraint for them. This study proposes a model outlining key steps for conducting bio-waste segregation training among selected hospitals to address this challenge and enhance MARIDI's mechanism process of attaining sustainability.*

Keywords*: Biodegradable waste management, training awareness, skilled workforce, sustainable practices, employee empowerment.*

Community-Based Waste Management Programs in Enhancing Family Environment and Psychological well-being in Smart Cities

Thokchom Anand Singh*
Department of Educational Studies, Manipur International University, India
**Corresponding Author: korokhomba@gmail.com*

ABSTRACT: *Aim: To consider the community-based waste management programs in smart cities on family environment and psychological well-being.*
Materials and Methods: A qualitative analysis of 34 studies in respect of eight key areas: family cohesion, stress levels and psychological well-being, improvement in family environment, interactions among family members, and mental health, impact of public awareness, socio-economic differences, role of collective responsibility, and improvement recommendations in the program.
Results: In-depth review suggested a strong positive relation between waste management by community groups and familial wellbeing. The principal findings were: enhancement of family cohesiveness based on mutual environmentalist values, reduced stress levels in the entering families, increased community networking, and psychological gain was observed mostly with the families belonging to the higher socio-economic strata. There were many socio-economic imbalances in terms of benefits gained from the program as is in the case of resource scarcity, the poorer families enjoyed psychological benefits to a lesser degree. Some of the factors that have made these programs successful included education, infrastructural improvement, and community involvement.
Conclusion: The community-based waste management programs reveal an important positive impact towards the family environment as well as towards psychological well-being for smart cities. Such programs benefit the environmentalist responsibility and the cohesive family, redress of socio-economic disparities is very important to ensure equitable benefit distribution.

Keywords*: Waste management, Family environment, Psychological well-being, Smart cities, Sustainability.*

Wastepreneurship and Urban Community Development (Study of the Existence Waste Banks in Semarang, Indonesia)

Ririh Megah Safitri*
Department of Sociology, State Islamic University Walisongo Semarang, Indonesia
**Corresponding Author: ririh.megah.safitri@walisongo.ac.id*

ABSTRACT: *Piles of rubbish are a crucial problem for urban communities, including Semarang. As the center of provincial government, Semarang then transformed into a melting pot area that accommodated immigrants with various interests that accompanied their mobilization process. The dense flow of population mobilization with the rhythm of urban community activities practically leaves problems such as excess waste production which leads to a decrease in the quality of life if not managed well. Based on qualitative research methods and a descriptive approach, this field research exposed the existence of waste banks in Semarang to examine alternative waste management movements based on empowering urban communities. In this context, the community is actively involved in the waste management process which is oriented towards adding economic value from waste. The findings of this research indicate that the wastepreneurship program initiated by the waste bank in Semarang is considered effective in sorting waste that can still be used before it ends up in the final landfill for Semarang waste. There are three final conclusions in this research, first is that wastepreneurship can improve the economy of urban communities. This is related to the process of turning waste into crafts and multifunctional products that provide economic value to sorted waste. Second, wastepreneurship can increase the knowledge and skills of urban communities. In this context, the waste bank provides assistance and education regarding the waste sorting and utilization process. Third, wastepreneurship ultimately functions as a space for dialogue for the community and related stakeholders. Relationships and networks are significant capital in sustainable waste management.*

Keywords*: Waste; Wastepreneurship; Community Development; Urban Society.*

Circular Economy Entrepreneurship in Developing Countries: Challenges and Opportunities

Chirra Baburao*, Paruchuru Manjushree, Indukuri Bangar Raju

Department of Entrepreneurship, GITAM School of Business GITAM Deemed to be University, Gandhi Nagar, Rushikonda, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: bchirra@gitam.in*

ABSTRACT: *A circular economy (CE) provides an alternative to the take-make-use-waste model, which aims for development without waste. While CE is a global phenomenon, its application in developing countries poses unique challenges and opportunities. This paper reviews the context of CE entrepreneurship for these economies, detailing key barriers against entrepreneurs and the potential nature of innovation-based help. Challenges: Developing countries have faced systemic barriers that hinder the scaling up of CE initiatives. This informality in waste management worldwide makes it very hard for formal businesses to enter and participate. The biggest bottleneck against scalability is the additional infrastructure required for waste collection, sorting, and processing. Financial constraints constrain entrepreneurs' funding options for consumers and businesses' market development — because they do not know solutions exist. One of the biggest obstacles to investment in CE initiatives is uncertainty because of inconsistent and unclear regulations.*

Opportunities: Developing countries bring specific strengths to CE entrepreneurship. So, countless waste materials sit around doing nothing, which means an opportunity for some genuinely creative business innovation. The waste processing and upcycling for some CE ventures could thus be significant employment generators, offering a means to tackle enduring social problems such as pollution, environmental degradation (including resource depletion), public health hazards, and poverty. In such contexts, the constraints can be drivers of innovation and lead to an impact achieved by more context-specific solutions. Growing demand for sustainable products and services worldwide is paving the way for market opportunities for low-income countries to take the lead in CE.

Research Directions: Future Areas of Investigation Further research is needed in several critical areas. Researchers must understand the relationship between formal and informal waste collection avenues to design effective inclusive CE models. Scaling CE ventures requires innovative, low-cost solutions adapted to limited infrastructure. Alternative financing mechanisms, such as microfinance and impact investing. Market Pull: Requires practical means, such as raising awareness and a behaviour change campaign to ramp up market demand. Last, mapping the current policy landscape and identifying where it can be improved makes operating within a supportive environment for CE entrepreneurship possible.

Methodology: This Systematic Literature Review (SLR) protocol uses Scopus as an exclusive database and will target research on circular economy (CE) practices in entrepreneurship in developing countries. The publication window is from 2004 to 2024 to capture current findings. A search string containing keywords such as "circular economy," "entrepreneurship," "developing countries," "challenges," and "opportunities" is applied and refined using Boolean operators. According to PRISMA guidelines, screening includes title and abstract reviews leading to a full-text assessment. The extracted data focuses on regional characteristics, CE strategies, challenges, and results. Thematic analysis is used to synthesise patterns and identify relevant trends.

Conclusion: The opportunities for CE entrepreneurship become more challenging to pursue and maintain in developing countries. Context-specific solutions can be achieved, and both help overcome the inherent barriers in these places while using their unique strengths as drivers for economic growth and environmental benefit. The full realisation potential of CE requires further research as well-targeted policy interventions in this region.

Keywords:

Urban Residents' Behaviour towards Waste Management and Best Practices: Perspectives from Bangalore, India

Haniya Kalim[1], Bishakha Majumdar[2,*]

[1]Independent Consultant, India

[2]Organizational Behavior and human Resource Management, India

**Corresponding Author: bishakha@iimv.ac.in*

ABSTRACT: *Purpose: Urban waste management is a pressing issue in rapidly growing cities like Bangalore, India, where population expansion and lifestyle changes have heightened the volume and complexity of municipal waste. This study examines the behaviors, attitudes, and challenges faced by Bangalore's urban residents in managing household waste.*

Method Through surveys and interviews, findings reveal mixed awareness and inconsistent practices in waste segregation, recycling, and disposal, largely influenced by socio-economic factors and infrastructural limitations. While some residents actively engage in sustainable practices, many see waste management as a government responsibility, reflecting a need for stronger community involvement and awareness.

Findings and value: The study also identifies best practices such as community-driven initiatives, enhanced waste segregation programs, and increased access to composting and recycling facilities as potential solutions. Recommendations include improved municipal collection systems, targeted educational programs, and policy measures to promote public par repation, ultimately fostering a more sustainable waste management culture in Bang.

Keywords*: Waste management, India, survey, best practices.*

Waste-Reduction in the Food Industry via Transparent Labelling and Consumer Education

Imana Pal[*]

School of Health Sciences and Technology, UPES, India

**Corresponding Author: Imana.pal09@gmail.com*

ABSTRACT: *Food waste and labelling are two interrelated challenges that significantly affect environmental conservation, food security, and sustainable development. Accurate and transparent food labelling is crucial for consumer decision-making, enabling informed choices regarding nutritional content, shelf life, and storage conditions. Labels like "use by" and "best before" dates can influence food waste by creating uncertainty about safety and quality. Consumers often dispose of food that is still safe to eat, increasing the global food waste problem, which accounts for around one-third of all food produced for human consumption. Moreover, insufficient understanding of food labelling could lead to waste at both household and retail levels. Thus, the abstract analyses how improved labelling techniques, including clearer date indications, storage guidelines, and consumer education activities, can reduce food waste by enhancing consumer understanding of the distinctions between safety and quality labels. It underscores the obligation of food manufacturers, retailers, and legislators to promote sustainable food labelling policies that align with the reduction of food waste. Confronting these difficulties via legislative measures, technological innovations in packaging, and consumer education is essential for attaining global food security and reducing the environmental effect of food production. This requires a collaborative endeavour across sectors to standardise labelling, reduce food waste, and advance sustainable food systems.*

Keywords*: Food waste, food labelling, food security, sustainable development, consumer decision making.*

Sustainable Innovation in India: A Gandhian Perspective

Saikat Banerjee*

Strategic Management, Management Development Institute Gurgaon, India

**Corresponding Author: saikat.banerjee@mdi.ac.in*

ABSTRACT: *This paper investigates the role of Gandhian principles in shaping sustainable innovation across Indian enterprises, focusing on simplicity, sustainability, and social harmony. The purpose of the study is to explore how these principles—rooted in Gandhi's philosophy of self-reliance, non-violence, and communal welfare—are operationalized by modern Indian companies in fostering inclusive and ethical business practices. Using a qualitative methodology, the research employs thematic analysis on secondary data gathered from four prominent Indian firms: FabIndia, Aravind Eye Care, Amul, and SELCO Solar. Findings reveal that Gandhian tenets such as trusteeship, local empowerment, and equitable access guide these organizations in creating sustainable business models that prioritize community well-being and environmental harmony. The implications underscore the potential of Gandhian philosophy to inform sustainable business strategies in emerging markets, where addressing social and environmental challenges is critical. The study's originality lies in its contextual focus on India, illustrating the adaptability of traditional values within contemporary innovation frameworks, thereby highlighting Gandhi's enduring impact on sustainable business practices.*

Keywords*: Sustainable innovation, Gandhian principles, Indian enterprises, Social equity, Community empowerment.*

Engaging Dads: Experiences of Fathers in Indonesian Urban Families

Nur Hasyim*

Department of Sociology, Faculty of Social and Political Science State Islamic University Walisongo Indonesia

**Corresponding Author: nurhasyim@walisongo.ac.id*

ABSTRACT: *In the Indonesian context, the extent of father's involvement in childcare is comparatively lower than that of mothers. This discrepancy is inextricably linked to the prevailing social norms that categorize childcare primarily as a mother's obligation. Nonetheless, a new perspective is currently emerging regarding the important of father's participation in childcare activities. This paper aims to examine the perceptions of fathers within Indonesian urban families and to analyse the nature of fathers' engagement in childcare practices. The paper employs caring masculinity theory as an analytical framework This framework argues that societal structures inhibit male participation in caregiving roles, as such roles are frequently associated with femininity. Furthermore, this theoretical perspective regards caring masculinity as opposition to hegemonic masculinity, which predominantly underscores attributes of power and dominance. However, it is posited that caring masculinity can coexist alongside hegemonic masculinity. Additionally, this framework acknowledges that caregiving masculinity is subject to variation in accordance with the diverse social identities of men. This study employs qualitative research methodologies, utilizing Focus Group Discussions (FGD) and interviews as primary data collection techniques. This study reveals that fathers hold a range of perspectives concerning their roles in childcare; however, on the whole, fathers tend to perceive childcare as primarily a female responsibility. This viewpoint shaped by dominant gender norms within society. Nonetheless, practically, fathers engage in child-rearing in various model. The diversity of fathers' participation in child-rearing is strongly linked to the diverse social circumstances of the fathers involved in this study..*

Keywords*: Childcare, Father, Caring Masculinity, Gender Norms.*

Consumer Preferences and Sustainable Marketing Strategies for Britannia Products in the FMCG Sector

G Naveen Chandra*
GITAM School of Business, GITAM University, Visakhapatnam, India
**Corresponding Author: ngiddi@gitam.in*

ABSTRACT: *The Research examines Consumer Preferences related to Britannia products and recommends improvement in the marketing and operations strategies with least wastage, hence retaining the sustainability level in FMCG industries. The study considers dynamic Indian situations with a sample of 53 consumer responses and has been subjected to Factor Analysis, thus deriving influential factors in the customer buying decisions. In order to conduct Factor Analysis, an attempt has been made by testing the suitability of the data set for the analysis with the Kaiser-Meyer-Olkin (KMO) test. There are four major factors identified, namely Quality at an Affordable Price, Convenience and Access, Personal Preferences, and Discount Sensitivity. Results show that Brand Loyalty, Price Awareness, and Quality of the Product have been found to have a considerable influence, along with other determinants such as availability and ease of access, taste preferences, and social influences like advertisements and family recommendations. Through proper coordination of sustainable marketing, distribution, and inventory policies, according to the preference of these consumers, waste reduction at the unsold or expired product level for Britannia will be supporting the circular economy. The study concludes with actionable recommendations to Britannia regarding product availability refinement, the improvement in aesthetics of the package, and targeted promotion of their products across all types of consumer segments. Research and insights from the present work are very relevant and have a great impact on understanding consumer behavior in the FMCG sector and underlines data-driven decisions to create sustainability in Market growth.*

Keywords*: Consumer Preferences, Factor Analysis, FMCG (Fast Moving Consumer Goods), Distribution, Sustainable Marketing.*

Integrating Sustainability in Market Penetration for Britannia Dairy Beverages

Guttula Swathi*
GITAM School of Business, Marketing & Operations, GITAM University, India
**Corresponding Author: swathiguttula86@gmail.com*

ABSTRACT: *This project sought to establish the relationship between sustainable practices and the market penetration for Britannia dairy beverages brand "Winkin Cow". Considering the constant increase in consumer concern for environmentally friendly products, integrating sustainability into Britannia's Business strategy presents a valuable opportunity for market expansion. A survey with 33 respondents was conducted to analyze consumer preferences, using cross tabulation analysis and chi-square test to test the relationship between age and the frequency of purchasing behaviour of Ready-to-drink beverages. However, there is no significant relationship with purchase frequency. This meant that consumers' attention to ready-to-drink beverages could be less demographic but could be influenced more by sustainable practices like Eco-friendly packaging as a market penetration tool, sustainable consumer engagement through recycling initiatives, and community-based campaigns as practical strategies for market growth. Bringing awareness about waste management as social responsibility and leading as Brand Activation. The analysis indicates that market penetration can be fulfilled with sustainable environmental goals which offers a powerful tool for differentiating from other competitors. Britannia can strategically integrate these sustainable practices throughout the manufacturing process, packaging and end consumer outreach. The promotion of sustainability in Britannia Dairy beverages is crucial for achieving business success and fulfilling our corporate social responsibility (CSR).*

Keywords*: Sustainability, Britannia dairy beverages, Environmental impact, Brand Awareness, consumer behavior.*

Women and the environment: the contribution journey of silent actor for life sustainability in climate change (Studi In Demak, Indonesia)

Masrohatun, M.Si*

Lecturer in Department of Sociology, Faculty of Social and Political Science State Islamic University Walisongo

**Corresponding Author: masrohatun@walisongo.ac.id*

ABSTRACT: *This study reviews literature on the relationship between women, climate change, and the environment. In some literature, women were depicted as weak actors, inactive and silent in public forums. However, this study will describe about (1) how women understand their environment before climate change, (2) the impacts of climate change for their life, and (3) what women had done to survive amid flooding caused by climate change. Using qualitative research methods with an ethnographic approach framed by gender perspective on sustainable development theory, the study showed that memories of the past prosperity of their village inspire women to fight adapting to the increasingly widespread flooding. Weak disaster mitigation exacerbates the economic, social, environmental, and religiousness impacts of flooding in the area. Despite these conditions, women were able to contribute and adapt simultaneously. These results indicate that women, often seen as silent actors or second-class beings, did not fit this stereotype in this situation. In this context, women had proven that they could be integral and innovative figures in unusual circumstances arising from climate change. A gender perspective must continue to be integrated into government policies, especially regarding climate change issues.*

Keywords*: Women, silent actors, climate change, tidal flood, and environment.*

Gendered discourse in Ecological Practices: Representation and power dynamics in women's roles (study in Klego Village, Indonesia)

Kartika Indah Permata*

Dept. of Sociology, Faculty of Social and Political Science, State Islamic University Walisongo, Indonesia

**Corresponding Author: kartika.i@walisongo.ac.id*

ABSTRACT: *Many studies have proved that language can reinforce the destruction or protection of the ecological ecosystem. However, there has not been an in-depth exploration of how these elements shape gendered discourse, especially in the villages where environment has distinguished prominence for the people. Meanwhile, In Indonesian villages, many women have been living under the oppression of the patriarchal system amidst their environmental roles. This study aims to highlight how linguistic features are played to construct women's role in ecological practices and to investigate how the language used impacts women's position in societal hierarchy. Using descriptive qualitative design, the study was conducted in Klego village, a rural area in Central Java, Indonesia. The data was collected through observation, interview, and documentation. Then, it was analyzed using ecolinguistics approach through feminist perspective. This research discovered that various linguistic features, such as word order, sentence structure, lexical choice, speech act, and metaphor, shaped women's role in ecological practices, i.e., sustainable agriculture, resource management, waste management, education and advocacy, and biodiversity conservation. Further, it was found that the language used did not only reflect the women's role in environment, but also highlighted the power dynamics circulating in society where women were positioned as the second role within patriarchal structure. This, in turn, makes their contribution less visible. Finally, this finding implies the urgency for at least two aspects: (1) recognition of women's contribution to ecological practices and (2) integration of more neutral and balanced language that can encourage gender equality in society.*

Keywords*: gendered language, ecological practices, women's role, village, ecolinguistics*

Youth Environmental Activism in Social Media (Study on Instagram Account@pandawaragroup)

Akhriyadi Sofian*
Department of Sociology, Faculty of Social and Political Science State Islamic University Walisongo
**Corresponding Author: akhriyadi.sofian@walisongo.ac.id*

ABSTRACT: *The work of Pandawara Group began in 2022. They are five young people that initially felt concerned as their neighborhood often experienced flooding due to accumulated waste. Since then, they have started cleaning rivers of waste by involving the local community. This study is a cyber-media research. This research uses qualitative method and descriptive approach to study @pandawaragroup account. There are four programs conducted by the @pandawaragroup account include: first, river adoption. This program focuses on specific point along rivers that often becomes dumping sites. It involves cleaning and revitalizing these rivers with the active participation of local communities. Second, ajaraksa. A youth education initiative targeting teenagers, particularly aimed at educating the younger generation on environmental issues. Third, pancaranata. This program aims to ensure that environmentally conscious groups become a majority throughout Indonesia. Minority group dispersed across Indonesia receive training to become a major force in river management. Fourth, creator contribution. In this program, participants learn waste management skills from experts in various developed countries, enhancing their knowledge and capability in sustainable waste practices. This research is a qualitative research and use descriptive approach.*

Keywords*: pandawara group, youth, environmental activism, social media.*

A Study on Challenges of Diffusion of Eco-friendly Carry Bags

Bulla Jahnavai*, Gajula Thanuja, Poornima K
Acharya Bangalore B School, India
**Corresponding Author: jahnavireddybulla@gmail.com*

ABSTRACT: *There has been a notable surge in the need for sustainable packaging due to society's worries about waste, climate change, and lowering carbon footprints. Many businesses and start-ups have shown interest in using innovative yet practical approaches to green entrepreneurship. Food companies that have committed to phasing out single-use plastic, creating eco-friendly substitutes, and implementing an efficient system for gathering, sorting, and dispersing plastic garbage are proliferating in metropolises like Bengaluru. Customers and traders do not show much appreciation for their efforts because they all have different concerns. Quantitative research was conducted considering 146 replies from customers and 23 responses from traders to comprehend the thinking of both traders and customers. Two distinct sets of structured questionnaires were distributed as part of the study to collect responses. Data was gathered on a wide range of operational issues that traders deal with, including market interest, selling prices, buying expenses, and a host of other challenges. Comparably, an effort is made to comprehend how consumers feel about plastic carry bags in general and how they feel about alternative carry bags in general. Data was evaluated and presented using statistical methods. The key finding indicates that pricing has an impact on merchants' and customers' aversion to eco-friendly carry bags. In light of this, the researcher concludes her micro research that governments should provide incentives to producers and merchants to encourage consumers to buy and use biodegradable carry bags. The purpose of this micro research is to present the findings to the notice of policymakers, especially Industry bodies and government agencies to support and promote Start-ups and corporations that are into manufacturing and selling bio-degradable carry bags through subsidies, so that the repercussion effect will be positive in terms of the usage of biodegradable carry bags.*

Keywords*: Eco-friendly, carry bags, Policy makers, customer mindset, traders.*

Movement Towards Sustainable Citizens.

Shiv Rao Challa*
3R Zero Waste Pvt Ltd., India
**Corresponding Author: ceo@0waste.co.in*

ABSTRACT: *As urbanization accelerates in India, waste management challenges become increasingly complex, requiring both innovative technological solutions and ground-level interventions. We as, a climate-tech startup, introduced Karma Coins, a mobile application aimed at fostering sustainable practices among citizens by rewarding eco-friendly behaviors. Through a novel incentive system, KarmaCoins a future NFT encourages users to participate in actions such as waste segregation, Eco travelling, recycling, environmental education and responsible disposal. The app's design integrates educational content on sustainable practices, gamification elements, and a AI reward-based structure, motivating individuals to adopt and sustain environmentally positive habits over time. In tandem with this digital solution, 3R Zerowaste proposes an innovative waste segregation model: The 4-bin approach, Green Bin for Organic Waste, Blue Bin for Paper Waste; Orange Bin for Plastic Waste and Red Bin for Electronic waste / metals). By doing so, it facilitates More effective sorting at the source, allowing for safer disposal of harmful materials, greater recycling efficiency, and a reduction in landfill dependency. The synergy between the Karma Coins app and the 4-bin model is designed to create a feedback loop where digital engagement translates to on-ground behavioural change, enhancing community-wide waste management efforts. This is just 1 example how sustainable action can make and impact. This paper explores the development, implementation, and projected impact of the Karma Coins app in urban Indian communities. Early-stage user data, adoption patterns, and environmental outcomes from pilot projects suggest promising improvements in waste segregation practices and overall community engagement.*

Keywords*: waste management landscape, Policy frameworks, opportunities, municipalities, conversation*

Closing the Loop: When Deals Are About More Than Money – Leveraging Relationships to Drive Sustainable Solutions

Ofira Ayalon*
School of Environmental Sciences, Natural Resource & Environmental Research Center, University of Haifa
Head of Environment & Energy Cluster, Samuel Neaman Institute, Technion ,Haifa
**Corresponding Author: ofira@sni.technion.ac.il*

ABSTRACT: *Industrial symbiosis is an example of the contribution of the circular economy approach to the productivity of the economy. The waste of one plant is a resource for another plant, while reducing environmental damage and contributing to the competitiveness and prosperity of the industry. The industrial symbiosis project in Israel, launched in 2019 by the Ministry of Economy and Digital Israel, facilitated partnerships between industries, allowing waste from one business to become raw material for another. After the pilot year, the Ministry of Environmental Protection joined the project. The Ministerial funding was dedicated to fund the dealers- two national franchisees, whose role was to match between the industrial plants. The project was active until 2023. By promoting reuse and recycling, the project has contributed to waste reduction, cost savings, and energy conservation. While specific savings data isn't detailed, the platform actively supported more than 5100 businesses, achieving 223 waste-deals, more than 100 million NIS (ca. 25 million US$), more than 65,000 ton of different wastes were reused or recycled (instead of being landfilled) and almost 1.4 million tons of quarry remains. The legislation defining "End if Waste" does not exist in the Israeli law book and is one of the main limitations to expanding the project and to increase the benefits from it.*

Keywords*: Industrial symbiosis, Circular economy, waste-deals.*

Changing Household Waste Separation Behaviour through Monetary Incentives, Nudges, and Unverified Self-Reports

Yair Zadik*, Hagai Katz
Ben-Gurion University of the Negev, Beer Sheva, Israel
**Corresponding Author: yair.zadik@gmail.com*

ABSTRACT: *The issue of municipal solid waste (MSW) is a fast-growing global environmental issue, resulting in severe public health and environmental problems. The most significant environmental problem is that most MSW is being landfilled or dumped, mainly in lower-income countries. European countries have reduced their landfilled waste by implementing separation at source, accompanied by different technologies. One of the main hurdles is the willingness of people to separate waste at home. Experiments have found that economic incentives can help change behaviors regarding separating materials from waste, but the verification process before providing incentives is lacking. We developed a new model we call Self Reporting Based Incentive (SRBI) model, which combines principles of behavioural economics with micro-rewards based on self-reports. The SRBI model uses a communication channel for information and nudges. This channel also serves for the participants' self-reports and to inform them about the rewards they have earned; in many cases, the rewards were used as "pocket money" for children, involving them in the separation processes as environmental education. To test the model, we conducted three extensive field experiments in communities with high, medium, and low socioeconomic (SE) status, with different living environments, and different streams of waste to separate. The results were beyond encouraging: the participating families more than tripled their amounts of material separated from waste; participants reported that their behaviour towards waste separation in has dramatically changed; this innovation may affect both research on environmental behavior change and policymaking.*

Keywords*: Municipal Solid Waste, Waste Management, Separation at Source, Recycling, Self-reporting.*

Accessing the Impact of Fintech on Credit Accessibility and Financial Inclusion in Nigeria

Ahmad Bala Na'iya*, Haroon Rasheed
Management Skyline University Kano, Nigeria
**Corresponding Author: ahmadbalanaiya@gmail.com*

ABSTRACT: *This study aims to evaluate the impact of financial technology (Fintech) on credit accessibility and financial inclusion in Nigeria, focusing on specific dimensions of Fintech: accessibility, innovation and the regulatory environment. Although Fintech in Nigeria is burgeoning, large gaps still exist between the banked and unbanked and between the underbanked and fully banked due to high barriers (poor digital literacy, limited regulatory environment and lack of access to financial services). This paper addresses the critical need for nuanced understanding of how different fintech dimensions impact on financial inclusion and credit access. A structured questionnaire was used as the primary data collection instrument and a quantitative research design was employed. The questionnaire was created to ask inquisitive on the various dimensions of Fintech and their implication on credit accessibility and financial inclusion. The FUGAZ banks (First Bank, UBA, GTB, Access Bank, and Zenith Bank) customers and employees, who are in Kano were the population for this study. An estimated total of 1200 individuals were targeted, with an estimated 800 customers and 400 employees. Cochran formula was used and 276 was used as the sample size. Thus, both customers and employees were sampled in a stratified random sampling way in order to ensure good representation of the level of each demographic segment. From the 276 distributed questionnaires, 245 (88.8%) were returned out of which 245 questionnaires were samples to be analyzed. Increased access to Fintech services was found to better enhance credit availability, and individuals reported more financial opportunities whose access to Fintech services is improved. Fintech innovation was also seen as a critical factor for financial inclusion and a supportive regulatory environment was also seen as key to growth and enhanced accessibility to credit for Fintech. As a result, the study recommends the development of targeted financial products for the underserved, enhancement of digital literacy programs, increased collaboration between banks, Fintech businesses as well as the regulatory bodies to build a more holistic financial environment in Nigeria. The findings further indicate the importance of Fintech in realizing a truly inclusive and financially accessible Nigeria, and the necessity for an all-encompassing Fintech strategy to realize economic inclusion among the unbanked and under banked populace.*

A Case Study: Maintenance activities in aquaculture structures

Prabhu S [1],*, A. Mahalakshmi[1], B. Vijaya[1], A. Hemamalinie[1] , S. Ganeshpandi[1], P. Vasanthi[2]

[1]M.G.R. Educational and Research Institute, Chennai, India
[2]Chennai Institute of Technology

**Corresponding Author: prabhuciba28@gmail.com*

ABSTRACT: *This study was identify the maintenance activities in the aquaculture structures such farms, ponds, hatcheries etc., This paper reviews the related literature on maintenance activities and repairs on building structures. Questionnaires, interviews and field inspections were used to obtain data from aquaculture structures. The study revealed that the maintenance practices at aquaculture structures are mostly routine involving desalting of earthen type ponds, deterioration of concrete tank, repair of electrical provisions for pumping of water & aeration purpose, replacement plumbing line for supply of waters etc., there also weekly maintenance schedules for all the tanks and electrical & plumbing periodically scheduled. These all are predictive and preventive maintenance works. Long-term quality and structural safety are additionally maintained by maintenance procedures, which can avert the abrupt collapse of the entire building by preventing the principal structure from breaking down. Nonetheless, the investigation discovered a discrepancy between the aquaculture infrastructure maintenance procedures and their quality maintenance procedures. The paper's conclusion suggests that maintenance be taken into account in the early stages of construction and that it must be completed with the best quality of aquaculture professionals, materials, and components; therefore, it is necessary to involve aquaculture professionals from the design to construction stage at the very least, and to raise awareness of the risks associated with neglecting maintenance and the benefits of proper maintenance practices.*

Keywords*: Maintenance, activities, aquaculture, structures.*

Mapping Consumer Behavior in Sustainable Fashion: A Systematic Literature Review (SLR) through the TCCM Framework

Pappu Sindhuja*, K. V. V Devi Prasad, Sai Deepti Udandrao

Department of Marketing, GITAM School of Business, Gandhi Institute of Technology and Management, deemed to be University, Visakhapatnam, India

**Corresponding Author: spappu2@gitam.in*

ABSTRACT: *Growing environmental concerns and a trend toward more ethical shopping practices have fueled an increase in the amount of study on the consumption of Sustainable products during the past ten years. Although most people have good opinions of sustainable Products, actual sales rates are still low, which causes a disconnect between what people think and what they do. A thorough analysis of the literature on sustainable fashion is necessary because the results of current research are inconsistent, with some showing contradicting conclusions. By looking at important theoretical frameworks, sociodemographic variables, geographical contexts, and the most researched product categories, this study seeks to evaluate the present status of research on sustainable fashion. The study TCCM frameworks to systematically search, select, and synthesize relevant data, providing an in-depth mapping of the existing literature. This approach allows for a critical evaluation of theoretical foundations, the various contexts influencing sustainable fashion, and the methodologies used in prior studies. Research on sustainable fashion is dominated by Theories, according to this study, which highlights the need for a more comprehensive theoretical framework. In order to help marketers better target untapped customer niches, the study identifies underexplored product categories, sociodemographic groupings, and geographic locations. The Research also identifies important factors that facilitate and hinder the purchase of sustainable clothes and recommends greater research into these factors to create more potent marketing campaigns*

Keywords*: Sustainable fashion, TCCM, Slow Fashion, Green Fashion, Consumer Behaviour*

Navigating the Waste Management Crisis in India: A Social, Cultural, and Policy Perspective

Radhika Nehwal*, Ajit Kumar Lenka
India
**Corresponding Author: rdhk8754@gmail.com*

ABSTRACT: *The swift urbanization, growing population, and transforming consumption behaviours in India have led to a grave waste management crisis. Every year, the country produces millions of tons of waste-from which a large portion is either not treated as it should be or remains unprocessed. Further deterioration is caused by environmental degradation, health hazards, and inefficiencies in infrastructures. Established policies notwithstanding, the issue faces heightened complications due to infrastructural deficits, societal behaviour, and regularized enforcement practices. The objective of the study is to understand the existing gaps and inconsistencies in waste management policies and practices. The also tries to understand the best practices for waste management improvement public awareness, education, and changes in behaviour. Evaluate the possibility of using a circular economy model to make a waste management system more sustainable and efficient in India. Methodology-This study will mainly consist of body form of secondary data in government reports, research studies and industry publication. From the policies, infrastructure and roles of the stakeholders, which consist of a mix of municipalities, private sector, and informal waste sector, case studies are also used to draw best practices from cities that have been successful with their initiatives on waste management. Findings-High growth in urbanization, rapid economic development, and consumption patterns have resulted in creating enormous and unregulated quantities of waste. Inefficient Management: The dominating conventions essentially comprise unscientific disposal practices that eventually become environmental and health hazards. Interrelated factors regarding social, cultural, and policy influences come together to shape the crisis.*

Keywords*: Waste management, Socio-cultural, Policy perspective, India*

Impact of job demands- control- social support on work-family conflict, well-being of Odisha healthcare workers: A Gender-Sensitive Approach Aligned with SDG 3

Akankhya Panda*, Sowdamini Thatta
Gandhi Institute of Technology and Management, deemed to be University, Visakhapatnam, India
**Corresponding Author: apanda2@gitam.in*

ABSTRACT: *The rising incidence of work-family conflict (WFC) among primary healthcare personnel emphasizes an urgent need for solutions that match with Sustainable Development Goal 3: guaranteeing healthy lives and fostering well-being for all. This study examines the impact of job demands, control, and social support on WFC and psychological well-being among 150 primary healthcare professionals in southern Odisha, particularly concerning gender differences. High job demands and domestic responsibilities pose unique challenges, especially for female healthcare workers, who experience greater role strain. Applying the Job Demand-Control-Support (JDCS) model, our findings reveal that enhanced job control significantly alleviates WFC among women. At the same time, social support universally reduces WFC and improves psychological well-being across genders. The results highlight the importance of developing gender-sensitive work-family policies and support systems that address the specific needs of healthcare workers, promoting their well-being, job satisfaction, and resilience. These initiatives are crucial for supporting a healthy, motivated workforce capable of delivering sustainable, quality care in underserved regions.*

Keywords*: Work -family conflict (WFC), SDG-3, Job Demand-Control-Support (JDCS) model, psychological well-being*

Awareness and Applications of Circular Economy Principles Among Construction Professionals in Türkiye

Burcu Salgın[1,*], Atacan Akgün[1], Kofi Agyekum[2], Judith Amudjie[3]

[1]Erciyes University, Department of Architecture, Kayseri, TÜRKİYE
[2]Department of Construction Technology and Management, Kwame Nkrumah University of Science and Technology, Kumasi, GHANA
[3]The Hong Kong Polytechnic University Kowloon, Department of Building and Real Estate, Hong Kong SAR

**Corresponding Author: editor@solid-waste.org*

ABSTRACT: *The construction industry significantly impacts environmental sustainability through resource consumption and waste generation. Circular Economy (CE) principles offer solutions to these challenges by promoting resource efficiency and waste reduction. This study investigates the awareness and application of CE principles among construction professionals in Türkiye, addressing a significant gap in the literature regarding CE implementation in developing countries' construction sectors. The research employed a quantitative approach, utilizing an online survey distributed to architects and engineers working in Turkish construction firms. The survey, completed by 98 professionals, assessed awareness levels of CE principles and their practical applications using a Likert scale. Data analysis includes descriptive statistics, one-sample t-tests, and correlation matrices to evaluate relationships between different variables. Results indicate varying levels of awareness and implementation across different CE principles. In terms of awareness level, recycling received the highest mean score (4.30), and repair/remanufacture (4.12). However, principles such as refuse (3.01) and recover (3.24) received lower rates. While recycling demonstrated the highest awareness level, it showed the lowest implementation rate (2.37). Only the repair/remanufacture principle yielded consistent results, ranking high in all dimensions. The findings suggest that while Turkish construction professionals demonstrate a strong awareness of basic CE principles, more complex applications require further development.This research contributes to the literature by identifying the necessary steps to successfully adopt CE practices in the Turkish construction sector. It is believed that this study can contribute to the understanding of CE implementation in the construction sector of developing economies and provides insights for policymakers and industry stakeholders.*

Keywords*: Circular Economy, Construction Industry, Türkiye, Sustainability*

Bio-Driven Solutions: Sustainable Pathways for Breaking Down Pesticide Residues and Protecting Public Health

Sandhimita Mondal*, Soumita Maji, Debalina Samanta

Department of Biotechnology, Brainware University, West Bengal, India

**Corresponding Author: sandhimita@gmail.com*

ABSTRACT: *This study explores the harmful impacts of various pesticides, such as Benzene Hexachloride (BHC), chlorpyrifos, cypermethrin, and atrazine, on both the environment and human health. These pesticides, through multiple exposure pathways, pose risks including neurotoxicity, cancer, and reproductive issues. Conventional degradation methods like incineration and hydrolysis have limited effectiveness and can produce harmful by-products. In contrast, bacteria-based remediation offers a promising, sustainable approach to breaking down pesticides. Specific bacterial species, such as Sphingomonas sp., Clostridium sp., and Pseudomonas sp., utilize enzymes and metabolic pathways to convert pesticides into non-toxic compounds. For example, enzymes LinA and LinB facilitate BHC breakdown, while chlorpyrifos degradation relies on organophosphorus hydrolase (OPH) and methyl parathion hydrolase (MPH). Additionally, Pseudomonas alcaligenes and Bacillus thuringiensis SG4 are effective in degrading cypermethrin and atrazine through enzymes like AtzA, AtzB, and AtzC. This study underscores the potential of bioremediation as a solution to pesticide pollution, advocating for eco-friendly approaches to sustainable agriculture and ecosystem protection through an understanding of bacterial mechanisms.*

Keywords*: Bacteria, Pesticides, Pathway, Public health.*

Understanding Determinants of Household Waste Segregation Behaviour in Hyderabad India: Insights from the Theory of Planned Behaviour

Swati Bothra*
Independent, India
**Corresponding Author: bothraswati03@gmail.com,*

ABSTRACT: *Using the Theory of Planned Behaviour this study investigates behavioural determinants of waste segregation of household waste in Hyderabad, India. Purpose: The research seeks to understand socio-psychological factors and the efficacy of government policies influencing waste segregation behaviour by urban residents to drive efficient and sustainable waste management practices. Methodology: A survey questionnaire on attitudes, subjective norms, perceived behavioural control, environmental knowledge and situational factors was used to gather information on factors influencing waste segregation behaviour of the urban residents. The empirical data collected from 120 residents were analyzed using Partial Least Squares- Structural Equation Modelling assisted by Smart PLS Software. Findings: The study found that attitudes, perceived behavioural control, environmental knowledge had a significant impact on waste segregation intentions, while situational factor like availability of separate waste disposal resources, directly impact segregation behaviour. Subjective norms and government policies had minimal effects on promoting actual segregation behaviour. Implications: The results of the study foreground the need for raising public awareness, enhancing community engagement and improving infrastructure to support effective household waste management practices. Policies should prioritize these aspects over enforcement to close the intention-behaviour gap. Originality: The study adds to the relatively small pool of work done in urban waste management behaviours in India. By extending TPB, it includes situational factors and policy impacts to provide for actionable insights for stakeholders to promote sustainable waste management practices.*

Keywords*: Solid waste management, source segregation, Swachh Bharat Mission, Theory of Planned Behaviour, PLS-SEM*

An Investigation on HIV/Aids Awareness Among Skyline University Students & Staff, Kano Nigeria

Maimuna Sidi Muhammad*, Innocent Ojeba Musa, Sanjoy Kumar Pal,Mr Abdulsalam Mustapha
Department of Microbiology, Skyline University Nigeria, Kano State
**Corresponding Author: maimunasidimuhammad@gmail.com*

ABSTRACT: *Since its discovery in 1981, HIV/AIDS has remained a global threat to public health and developmental progress. In Nigeria, the HIV epidemic is still a public health concern; as of 2020, 1.9 million individuals were infected. One of the main obstacles to stopping the spread of HIV and AIDS is inadequate understanding. Adolescents account for almost half of all new HIV infections.. The HIV/AIDS knowledge survey was carried out On the occasion of world HIV/AIDS Day on 1st December Skyline university students and staff. The Aim is to ascertain the participant's degree of HIV/AIDS knowledge. Out of the 155 subjects that took part in the study, 126 were Skyline University students and 29 were staff members. A printed well-structured questionnaire (Annexure I) covering various aspect of how HIV spread, its treatment, and prevention aspect etc. were given to willing subjects. Their responses were collected on the spot. The responses of the subjects were first tabulated and analyzed using SPSS 16 software. The study's primary conclusion showed that present students' understanding of HIV/AIDS is mediocre. In order to maintain this trend, HIV/AIDS interventions that college counselors may implement were recommended.*

Keywords*: Epidemiology, Human Immunodeficiency virus, Acquired Immunodeficiency Syndrome.*

Gamification: Use of Gamefied Elements for Promoting Sustainable Behaviour

Iimt University
**Corresponding Author: Yasharizvi2@gmail.com*

ABSTRACT: *This research focuses on leveraging game elements in sustainable marketing to enhance consumer engagement and foster long-term behaviour change towards sustainability. By incorporating elements such as VR/AR, points, badges, and challenges, marketers can create interactive and enjoyable experiences that encourage consumers to adopt sustainable practices However, the effectiveness of different game elements in the context of sustainable marketing remains a relatively unexplored area. This study concentrate on expects to address this information hole by exploring the effect of various game elements on consumer engagement and their potential to drive lasting behaviour change. To accomplish these targets,, a combination of qualitative and quantitative methods will be employed. Interviews and focus groups will provide valuable insights into consumer perceptions and attitudes towards gamification in sustainable marketing. Concurrently, experiments or surveys will be conducted to assess the influence of specific game elements on consumer engagement and their willingness to adopt sustainable behaviours over the long term Additionally, the study will consider contextual factors that may influence the effectiveness of gamification in sustainable marketing campaigns. By examining specific sustainability issues, product categories, and target audiences, the research will uncover how these factors interact with game elements in driving sustainable behaviour change. The discoveries of thus examination will add to the current information by providing practical recommendations on the most effective game elements for promoting sustainable behaviour in marketing initiatives. These insights will be beneficial for marketers and sustainability practitioners seeking to implement engaging and impactful gamification strategies that not only foster short-term engagement but also lead to sustained, positive changes in consumer behaviour. In conclusion, this study aims to bridge the gap in understanding regarding the optimal use of game elements in sustainable marketing. By enhancing consumer engagement and promoting long-term behaviour change towards sustainability, gamification can play a significant role in advancing sustainability goals and creating a positive impact on society and the environment.*

Keywords*: Game Elements, consumer behaviour, sustainable behaviour, long term behaviour change*

Struggle to success: Punarv Charitable Trust

Padmaja Venigandla*
Punarv Charitable Trust
**Corresponding Author: padmajamail@hotmail.com*

ABSTRACT: *Punarv Charitable Trust, a key initiative of Jattu Ashram, is dedicated to fostering sustainable development through innovative waste management, promoting a circular economy, and responsible natural resource management. Located in India, Punarv operates with the philosophy of integrating ecological resilience with economic and social enterprises, ensuring environmental sustainability aligns with community wellbeing and economic growth.*

Waste Management:

Punarv approaches waste management with a comprehensive strategy aimed at reducing waste at its source, recycling materials wherever possible, and responsibly disposing of the rest. The initiative employs various methods, such as waste segregation, recycling programs, and composting organic waste. By educating the community and encouraging active participation, Punarv ensures that waste is viewed not as a problem but as a resource that can be transformed and reused. This approach not only reduces environmental pollution but also creates opportunities for local businesses and entrepreneurs in the waste management sector.

Circular Economy:

The principles of the circular economy are at the heart of Punarv's mission. The initiative seeks to create systems where products and materials are kept in use for as long as possible, extracting maximum value before recovering and regenerating products and materials at the end of their service life. By establishing Ecologically Resilient Economic Zones, Punarv promotes local industries that utilize waste materials, turning them into valuable products. These zones serve as hubs for green technologies and sustainable practices, fostering innovation and creating a robust local economy that thrives on sustainability.

Natural Resource Management:

Natural resource management is a critical component of Punarv's sustainability efforts. The initiative promotes the sustainable use of resources such as water, soil, and biodiversity. Through community-driven projects, Punarv encourages practices like rainwater harvesting, afforestation, and sustainable agriculture. These practices not only conserve resources but also enhance the resilience of local ecosystems. By involving local communities in these efforts, Punarv ensures that the benefits of natural resource management are felt at the grassroots level, empowering communities to take ownership of their environmental future.

Holistic Well-Being at Jattu Ashram:

As part of Jattu Ashram, which focuses on social, cultural, and spiritual well-being, Punarv complements the ashram's broader mission. Jattu Ashram conducts various cultural programs aimed at enhancing social cohesion, cultural enrichment, and spiritual growth. Together, Punarv and Jattu Ashram create a comprehensive framework that addresses both the physical and spiritual needs of the community, fostering a holistic approach to well-being Punarv Charitable Trust exemplifies a holistic approach to sustainability, where waste management, circular economy, and natural resource management are integrated into a cohesive strategy. By focusing on education, community involvement, and innovative practices, Punarv is building a model of sustainable development that can be replicated across different regions. This initiative demonstrates that environmental sustainability and economic development can go hand-in-hand, paving the way for a Future where communities thrive in harmony with nature.

Keywords*:*

Consumers Perception towards the Green Products

Khyati Singh*
Nirmalya Eco Products Pvt. Ltd, India
**Corresponding Author: director01.nirmalyaeco@gmail.com*

ABSTRACT: *Consumers Perception towards Green Products in East Noida," investigates market trends and consumer preferences for natural and eco-friendly products, focusing on SAAKHYA-upcycled items made from the flower waste. The analysis indicates a decline in chemical products use and an increased demand for green alternatives. Understanding the product behavior is crucial for predicting consumer purchasing habits, yet there is a lack of data on this in the floral upcycled market. To meet the study's objectives, I used inferential statistical methods and case analysis to address flower waste management challenges. The exploratory design also introduced green marketing concepts, investigate various facets of flower waste management and explored consumer attitudes toward them. Nature of data is primary and the opinion of respondents has been captured by using semi-structured questionnaire methods on 4-point Likert type scaling. As consumers seek simplicity, brands with complex messaging need to reevaluate their value propositions. The study surveyed 850 individuals in their 20s and 30s in Noida, focusing on circular skincare products derived from flower waste. Findings revealed that emotional value has been identified one of the major determinants, major factor to determine propensity of the consumer, followed by economic risk, performance risk, product knowledge, environmental and safety value. Using inferential statistics, I analyzed how these behavioral factors impacted purchasing frequency, concluding that using eco-friendly products and upcycled items fosters greater engagement in the green market..*

Keywords*: green marketing, up-cycling, co-friendly, value-addition*

Value Creation from Waste: Roles and interface between the Informal and Formal waste Sectors in India and Denmark in a just circular transition

Rikke Marie Moalem[1,*], Sadhan Kumar Ghosh[2]

[1]Dept. of Sustainability and Planning, Aalborg University, A.C. Meyers Vænge 15, Denmark;

[2]SD & CE Research Center, International Society of Waste Management, Air and Water (ISWMAW), Kolkata, India

**Corresponding Author: rikkekr@plan.aau.dk*

ABSTRACT: *The global population is increasingly, urbanizing and growing wealthier, yet it is also becoming more wasteful. Each year, over two billion tons of municipal solid waste (MSW) is generated globally, a figure projected to nearly double by 2050, resulting in significant economic costs and hidden impacts such as resource depletion, pollution, and health challenges. This paper examines the distinct roles and potential collaborations between the informal and formal waste sectors in advancing circular economy principles and generating value from waste, using a comparative analysis of Denmark and India. Denmark's formalized, technologically advanced system exemplifies structured waste management driven by government policies, public-private partnerships, and waste-to-energy programs. In contrast, India relies heavily on an informal sector of waste pickers and small-scale recyclers, who play a critical role in resource recovery despite limited recognition and support with recent initiative of formalizing waste pickers in Swachh Bharat Mission. This study assesses how both sectors contribute to reuse, recycling, and environmental sustainability in different socioeconomic and regulatory contexts. Key findings reveal that while Denmark excels in waste segregation, advanced recycling, and energy recovery, India's informal sector demonstrates high material recovery efficiency but faces unsafe and inequitable conditions. Furthermore, Denmark faces challenges in extending product lifespans and complying with EU mandates for Preparation for Reuse (PfR), while India's informal sector struggles for recognition and safe working conditions. By analyzing the dynamics of formalization and collaboration, and identifying challenges posed by infrastructure and policy gaps, this study explores opportunities and barriers to integrate informal waste workers into formal systems. The findings contribute to understanding how diverse waste management approaches can foster circular economy goals and provide insights for policymakers seeking to optimize collaboration and improve sustainability in both high- and low-to-middle-income countries. Equally important, fostering consumer responsibility and awareness is vital, as focusing solely on waste sorting, reuse, and recycling will not suffice. A stronger emphasis on waste prevention is necessary to truly reduce waste at its source.*

Keywords*: Circular Economy, Just Transition, Formal and informal Waste sector, value creation, India, Denmark*

Localizing selected Education for Sustainable Development programs: A journey of selected public schools in the Philippines towards sustainability

Carmina S. Vicente*, Arlen A. Ancheta
University of Santo Tomas, Espana, Manila
**Corresponding Author: csvicente@ust.edu.ph*

ABSTRACT: *Education for Sustainable Development (ESD), UNESCO's response to the urgent challenges our planet faces, empowers citizens to contribute to environmentally sound, economically viable and socially inclusive futures (UNESCO,2024). The Philippines, challenged with environmental hazards, recognizes the role of schools in ESD promotion with the institutionalization of its integration through Environmental Education (EE) and other programs. Anchored on systems theories, localization and ESD frameworks, this multiple case study ascertains how ESD programs particularly waste management-related ones are localized and translated in selected public schools being a DepEd's mandate to integrate environmental concerns in the school curricula to unravel the issue of localization of Eco-Savers program in four (4) selected large public schools with 41 participants in the cities of Caloocan, Malabon, Navotas and Valenzuela (CAMANAVA). Varied corpus of data was examined using descriptive statistics, documentary review, with-in and cross case analysis and thematic coding. Findings revealed that ESD is translated through policies and programs which are found to be interconnected in public elementary schools in the CAMANAVA area following both top-down and bottom-up approaches as to institutional arrangements with national policies influencing the local programs. Mean scores in the survey results showed that Eco-Savers Program (ESP) (3.76), Search for Sustainable and Eco-Friendly Schools (SSEFS) (3.71) and Green School Program (3.61) were all deemed to be relevant and significant to a great extent by the participants with 26.8% claiming to emphasize ESP in their context in terms of environmental values, ecological waste management and system of organizing spaces. Distinct way of promoting ecological values and skills are maintained with the Eco-Savers Program and "Pera sa Basura" (Money from wastes) emphasized in CAMANAVA. Analysis of data showed that localization of ESD is evident in terms of a) physical environment and facilities; and b) practices in school. Mean scores of most of the knowledge, skills and values deemed to promote SD literacy are largely in support of the ecological pillar of SD. Solid waste management is considered as the top 1 practice implemented in school campus, facilities, and operations considering solid waste as the main problem in their locale. This study concludes that promotion of inclusive and bottom-up process of policy formulation and implementation, adaptation of ESD programs and integration of EE particularly waste management in the school environment, curricula and teacher training are significant in the journey to sustainability.*

Keywords*:*

Impact of Workplace Spirituality on Employee Wellbeing: A study on the Indian Public Sector Banking Industry

Sunitha L Ramavarapu*, Rama Krishna Gupta Potnuru
GITAM School of Business, GITAM University, Visakhapatnam, India
**Corresponding Author: sramavar@gitam.in*

ABSTRACT: *Indian public sector banking industry witnessed tremendous change in the last two decades. The inclusion of sophisticated technological innovations, novel structure of operations, merger of banks created opportunities as well as challenges to the Public Sector banks (PSB's). The cut throat competition from private sector banks is also posing a major challenge for the PSB's. To cater to the customers and to face the stringent competition, the PSB's increased their services multi-fold resulting in the over-load of work thus demanding longer working hours from its employees. "Bank employees are experiencing problems like job burnout, stress, and job dissatisfaction". The performance targets also put heavy pressure on employees resulting in high stress and burnout. Hence it is highly imperative for the banking sector to focus on addressing the well-being of the employees. In this context, the concept of workplace spirituality is gaining popularity in addressing HR issues in organisations that aim towards the well-being of employees. This paper aims to study the effect of Workplace Spirituality on the Employee Well Being in the context of Indian public sector banking industry.*

Keywords*: Employee Well Being, Workplace Spirituality, Indian Public Sector Banking industry, Stress Management, Meaningful Work and Mindfulness*

Digital Innovation for Sanitation and Hygiene Financing: The Transactional Ledger

Pamela Bundi*
FINISH Mondial
**Corresponding Author: pkananu@gmail.com*

ABSTRACT: *FINISH Mondial Kenya leverages digital innovation to tackle financial barriers hindering access to improved sanitation and hygiene. Recognizing the constraints faced by households and micro, small, and medium enterprises (MSMEs)—such as limited credit access, affordability, and poor financial literacy—FINISH Mondial developed the Transactional Ledger, a digital application aimed at enhancing financial inclusion and accountability. The Transactional Ledger empowers community-based savings groups, individuals, and informal lending mechanisms (e.g., chamas and VSLAs) to digitize their financial records. By formalizing savings and loans, it improves transparency, trust, and access to credit, making these groups viable candidates for sanitation and hygiene investments. Users can generate statements, manage loans, and monitor transactions, which facilitates partnerships with financial institutions. This tool has transformed traditional table banking models, increasing group savings by 40% and enabling investments in sanitation facilities and businesses. Embedded in social norms, the platform motivates users to prioritize sanitation improvements while growing their financial independence. Key to its success is tailored support: FINISH Mondial organizes groups, establishes governance rules, trains members in app usage, and links sanitation credit with tangible outcomes like improved facilities. By merging digital innovation with grassroots financial practices, the Transactional Ledger promotes sustainable sanitation and hygiene markets, offering a scalable solution to bridge financing gaps in underserved regions. This initiative demonstrates the potential of digital financial tools to accelerate progress toward universal sanitation access and hygiene equity.*

Keywords*:*

Supporting Households in Improving WASH and Rainwater Harvesting through Microfinance

Rohan Mallick*
WASH, Sanghamitra Finance
**Corresponding Author:*

ABSTRACT: *Access to adequate Water, Sanitation, and Hygiene (WASH) facilities and rainwater harvesting systems remains a critical challenge for many low-income households, particularly in rural and peri-urban areas. Microfinance has emerged as an effective tool to bridge the financial gap, enabling households to invest in sustainable WASH infrastructure and water security solutions. This paper explores the role of microfinance in supporting households to improve WASH facilities and adopt rainwater harvesting systems. By providing affordable credit and tailored financial products, microfinance institutions empower households to construct improved toilets, install handwashing stations, and implement rainwater harvesting structures. These investments not only enhance health outcomes but also contribute to water conservation and resilience against climate variability. Case studies from diverse regions demonstrate the transformative impact of microfinance, highlighting increased sanitation coverage, reduced water scarcity, and strengthened community awareness of WASH and water management practices. The paper also examines challenges such as limited financial literacy, repayment risks, and the need for supportive policies to scale up such initiatives. Recommendations include integrating financial literacy programs, fostering partnerships between microfinance institutions and WASH stakeholders, and leveraging digital tools to improve accessibility and accountability. By aligning microfinance with WASH and rainwater harvesting objectives, this approach offers a sustainable pathway to achieve universal access to safe water and sanitation while addressing broader environmental and social goals.*

Keywords*:*

Result-Based Financing in FINISH Mondial

Valentin Post*
Scaling and Growth, FINISH Mondial Foundation
**Corresponding Author: vpost@finishmondial.org*

ABSTRACT: *Result-Based Financing (RBF) has emerged as a transformative approach within the FINISH Mondial program, addressing critical challenges in sanitation and hygiene across India, Bangladesh, Kenya, Ethiopia, Uganda, and Tanzania. The model prioritizes outcome-driven solutions, incentivizing stakeholders based on measurable results, such as increased access to safe sanitation, sustainable use of faecal sludge management systems, and improved hygiene practices. This abstract explores the integration of RBF in FINISH Mondial's multi-stakeholder ecosystem, including governments, financial institutions, and communities, to align incentives for scalability and sustainability. The program leverages RBF to accelerate household toilet adoption, improve sanitation value chains, and ensure efficient resource utilization. By linking disbursement of funds to pre-agreed outcomes, the approach drives accountability, innovation, and community ownership. Case studies highlight how RBF mechanisms have unlocked financing, enhanced collaboration, and addressed barriers in sanitation markets. Insights reveal that RBF not only boosts the efficacy of public and private investments but also supports the broader goals of the Sustainable Development Goals (SDG 6) by promoting inclusive and equitable sanitation access. This paper concludes by recommending strategic pathways for scaling RBF in similar contexts, offering key learnings for policymakers and development practitioners globally.*

Keywords*:*

WASH Financing – A Global Perspective

Sarbani Bhattacharya*
FINISH Mondial Foundation, FINISH Mondial Foundation
**Corresponding Author: sarbani@impactxxl.com*

ABSTRACT: *Water, Sanitation, and Hygiene (WASH) financing is pivotal to achieving Sustainable Development Goal 6 (SDG 6), ensuring universal access to clean water and sanitation. Globally, the WASH sector faces a significant financing gap, necessitating innovative approaches to mobilize resources and scale impactful solutions. This abstract examines WASH financing trends, challenges, and opportunities across diverse geographies, focusing on the intersection of public, private, and blended financing models. The paper explores the role of traditional funding streams, including government allocations and donor grants, alongside emerging mechanisms such as results-based financing, microfinance, and social impact investments. Highlighting case studies from developed and developing countries, it delves into innovative financial instruments like revolving funds, impact bonds, and public-private partnerships that are reshaping WASH ecosystems. Emphasis is placed on equity-focused approaches, ensuring marginalized communities have access to affordable and sustainable WASH services. The role of community engagement, capacity building, and digital tools in enhancing financial accountability and governance is also discussed. This global perspective underscores the need for collaborative efforts between policymakers, financial institutions, and development agencies to bridge the financing gap. It concludes by offering actionable strategies to optimize resource allocation, attract investments, and build resilient WASH systems for a water-secure future.*

Keywords*:*

Waste Service and Value Chain Competitions Changing City-Level Management

Saurabh Agnihotri*
FINISH Society
**Corresponding Author: saurabhagni@finishsociety.com*

ABSTRACT: *Urban waste management is evolving rapidly as competition intensifies within waste service and value chains, prompting transformative shifts in city-level management systems. Traditional waste management models, often constrained by inefficiencies and limited resources, are being challenged by innovative service providers, public-private partnerships, and community-driven initiatives. This paper examines how competitive dynamics within the waste sector are reshaping urban governance, with a focus on efficiency, accountability, and sustainability. The emergence of private sector players and technology-driven solutions has disrupted conventional waste collection, segregation, and recycling systems. Competition fosters innovation, improving service delivery and optimizing resource recovery, while creating economic opportunities across the waste value chain. Case studies highlight successful models where competition has spurred the adoption of circular economy principles, enhanced financial transparency, and encouraged stakeholder collaboration. Cities are embracing decentralized management systems, digital tools for tracking waste flows, and inclusive strategies that empower informal waste workers. However, these transformations bring challenges, including regulatory complexities, ensuring equitable access to services, and balancing economic goals with environmental sustainability. The paper provides actionable recommendations to policymakers and urban planners to leverage competition while addressing systemic inequalities and environmental concerns. Ultimately, fostering healthy competition within the waste service and value chain has the potential to revolutionize city-level waste management, creating resilient and adaptive systems that align with global sustainability goals and the demands of a growing urban population.*

Keywords*:*

Cultivating Purpose- Driven Workplaces: Integrating Workplace Spirituality, Employee Well Being and Sustainability in the era of the Circular Economy

Sunitha L Ramavarapu*, P. Ramakrishna Gupta
GITAM University, Visakhapatnam, India
**Corresponding Author: sramavar@gitam.in*

ABSTRACT: *The world is entering into an era of Circular Economy with an aim to conserve resources and optimize their use. Even in the ever-evolving business landscape, the organisations are increasingly embracing the holistic approaches that balances economic success with social and environmental responsibilities. In this context, there is an ever-increasing necessity of these purpose driven workplaces which help create sustainable economies with eco-friendly practices aiming towards resource optimization and waste reduction. This paper delves into the concepts of cultivating such purpose driven workplaces emphasizing the integration of workplace spirituality, employee well-being and sustainability as the key components. Grounded in the principles of circular economy, it aims to explore how sustainable waste management, resource optimization and eco-friendly practices align seamlessly with strategies to enhance employee well-being. By integrating the concept of Workplace Spirituality which is centered on the core values like mindfulness, purpose, sense of community and shared values, organisations can cultivate a culture promoting environmental sustainability as well as personal fulfillment. This study highlights the synergies between these dimensions and their collective impact in the era of circular economy.*

Keywords*: Circular economy, workplace spirituality, employee wellbeing, sustainability, , sustainable waste management.*

Understanding Generation Z's Adoption of Hybrid Vehicles: The Impact of Attitude on Intentions

Shashidhar S Mahantshetti*, Anuradha H N, Priya.K
Department of MBA GSSS Institute of Engineering and Technology for Women Mysuru India
**Corresponding Author: nakshpriya1@gmail.com*

ABSTRACT: *In the context of growing environmental concerns and the global push towards sustainable transportation, hybrid vehicles have gained significant attention as a viable solution to reduce carbon emissions and fossil fuel dependency. This study investigates the factors influencing the adoption intention of hybrid vehicles among Generation Z consumers in Mysore City, India. Specifically, the research examines the impact of Environmental Concern (EC), Technological Perceptions (TP), Social Influence (SI), and Economic Factors (EF) on Hybrid Vehicle Adoption Intention (HVAI), with Attitude (Att) serving as a mediating factor. Generation Z, born approximately between 1995 and 2010, represents a critical demographic for the adoption of innovative technologies due to their distinct social, economic, and technological contexts. As digital natives, they are particularly influenced by technological advancements and social media, making them a key target for studies on sustainable transportation choices.Using a structured questionnaire, data were collected from 400 respondents in Mysore City through a convenience sampling method. The study employed Structural Equation Modeling (SEM) to analyze the relationships between the variables. The results indicate that Environmental Concern, Technological Perceptions, and Social Influence significantly affect Generation Z's attitudes towards hybrid vehicles, which in turn, strongly mediates their adoption intentions. Economic Factors also play a role, but their impact is more complex and varies based on individual financial priorities and constraints. This research fills a gap in the literature by focusing specifically on Generation Z in a developing country context, providing insights that can inform targeted marketing strategies and policy interventions. The findings suggest that promoting hybrid vehicles among young consumers requires a nuanced understanding of their environmental values, technological expectations, social dynamics, and economic realities. The study's implications are relevant not only for policymakers and marketers in Mysore City but also for stakeholders in other urban settings within India and similar developing regions.*

Keywords*: Hybrid Vehicle Adoption, Generation Z, Environmental Concern, Technological Perceptions, Social Influence*

Managing Waste through Social Entrepreneurship with the Help of Digital Marketing

Devara. S. Srinivas*, Suresh Sirisetti
GITAM School of Business, GITAM (Deemed to be University), Visakhapatnam, India
**Corresponding Author: ds.srinivasdevara@gmail.com*

ABSTRACT: *The rapid increase in waste generation worldwide has become a critical environmental challenge. Social entrepreneurship offers an innovative approach to addressing this issue by combining mission-driven efforts with sustainable business practices. Digital marketing plays a pivotal role in enabling social entrepreneurs to create awareness, reach target audiences, and scale their impact. This paper explores the intersection of waste management, social entrepreneurship, and digital marketing, highlighting strategies, challenges, and opportunities for creating a cleaner and more sustainable world.*

Keywords*: Waste Management, Green Marketing, Social Enterprise Branding, Digital Advertising etc*

A Study on Consumer Buying Behaviour towards Sustainable Packaging

Steffin Sam*
India
**Corresponding Author: steffinsamptpm@gmail.com*

ABSTRACT: *This study focuses on understanding Indian consumer's attitudes towards sustainable packaging within the context of physical retail stores. The population for this research consists of urban consumers in major Kerala city, particularly those who frequently shop in supermarkets and department stores. The study will specifically examine the packaging of everyday consumer goods, such as food products, beverages, and personal care items, as these are the most commonly purchased and packaged items.A quantitative research methodology was employed, using a structured questionnaire to gather data from 100 respondents across Palakkad city.The questionnaire assessed consumer preferences, awareness, and willingness to pay for products with eco-friendly packaging alternatives. Structural Equation Modelling (SEM) was used to analyse the data and identify key factors influencing consumer behaviour.This approach provides a clear understanding of consumer preferences, helping businesses and policymakers tailor their strategies to meet the growing demand for sustainable packaging solutions..*

Keywords*:*

Socio-Economic and Infrastructural Analysis of Rural India: A Case Study of Vadgaon Ghenand under Unnat Bharat Abhiyan

Shriram N. Kargaonkar[1,*], Latpate Sandhya[1], Vedant Salunke[1], P.V. Thatkar[2]

[1]MAEER's MIT Arts Comm. and Science College, Alandi, Pune, India
[2]Dept. of Community Medicine (PSM), PCMC's P.G.I. Y.C.M. Hospital, Pune, India
**Corresponding Author: shriramkargaonkar9@gmail.com*

ABSTRACT: *This paper explores the socio-economic conditions and infrastructure development in Vadgaon Ghenand, a rural village in Pune district of Maharashtra in India under the Unnat Bharat Abhiyan (UBA) initiative. Using primary data collected from 645 households, the study examines the demographic profile, caste-based poverty distribution, education, health facilities, water, sanitation, agricultural practices, and livelihood patterns. Key insights reveal significant strides in literacy, sanitation, and energy access, alongside challenges in income inequality, gender disparity in education, and limited healthcare infrastructure. The findings contribute to understanding the rural development landscape in India and offer potential policy interventions for sustainable development.*

Keywords*: Unnat Bharat Abhiyan, socio-economic, infrastructural, rural development Vadgaon Ghenand, sanitation, financial inclusion, HEI's.*

Value Dynamics Visionaries: Pioneering Sustainable Waste Management by Giving Value a Second Life

Raj Kumar Bhattarai*

Nepal Commerce CampusT ribhuvan University, Nepal
**Corresponding Author: raj@ncc.edu.np*

ABSTRACT: *Value and waste are often seen as opposites. If value persists, waste is minimized; but when value diminishes and becomes obsolete, it turns into waste. Value dynamics visionaries bridge this gap by breathing new life into waste, transforming it into a renewed source of value. They strive to give waste a "second life", making it useful. The value of a product traverses through three critical processes: creation, protection, and destruction. Each of these processes creat a complex interplay of value dynamics. The visionaries identify and navigate the pathways of creation to novelty, protection to continuity, and distruction to discontinuity of value. Waste management becomes laudable at the end of destruction phase, and the challenge is to mitigate the loss of oritinal value and instead, give it a second life. These visionaries also employ innovative strategies such as recycling, reusing, and repurposing to extend the life of value. Compliance, design thinking, frugal innovation, soially sustainable supply chain, and public awareness are the strategic advantages. The strategies not only conserve resources but also aligns with the principles of circular economy, where waste is minimized, and value is continuously regenerated. Ultimately, the end of one value's lifecycle can mark the beginning of a new one. The visionaries can architect innovative solutions, allowing what was once considered waste to become a source of renewed value in a continuous cycle of sustainability*

Keywords*:*

Food Waste Management in Restaurants of Peri-urban Communities: Evidence from Warri, Nigeria

David O. Olukanni, Emmanuel Samson, Daniel E. Bassey*
Department of Civil Engineering, Covenant University, Ota, Nigeria
**Corresponding Author: david.olukanni@cu.edu.ng*

ABSTRACT: *This study assessed the contemporary food waste management practices adopted by restaurants in the peri-urban areas of Warri, Nigeria. Qualitative and quantitative means were collectively employed in obtaining data. The qualitative aspect was based on two semi-structured questionnaires, one designed for customers while the other, for the restaurants' manager while quantitative data were obtained via direct sampling of food waste from each restaurants' waste collector. A total of thirteen (13) restaurants were considered, and four hundred and ten (410) customers responded to the survey. Results showed that the most adopted tool for waste collection across the selected restaurants is waste collection baskets (n = 9, 69.23%). 53.8% of the 13 restaurants get their waste accumulated and dispose of them on a weekly basis. Only 14.14% of customers felt restaurants perform excellently in their food waste management and disposal practices. 5 of the 13 restaurant managers admit that their service outlet currently faces challenges with waste disposal. 84.61% of restaurants employ the services of waste management agencies for their waste disposal needs. 30.7% of participating managers confirmed that their restaurant's food waste management and disposal practice pose obvious environmental concerns. The study recommends the use of compostable bins as well as intense public awareness exercises to promote sustenance in restaurant food waste management in peri-urban areas.*

Keywords*:*

Use of digital technology in HR A perception by students and Entrepreneurs

Dadi Srimanth Kumar[1], Atanu Talukdar[2]
[1]CMT Vizag. Chair, READ Entrepreneurship Development Cell, India
[2]KL University, Vijayawada, India
**Corresponding Author: srimanthkumar777@gmail.com*

ABSTRACT: *Today's dynamic and competitive business environment, technology and innovation have emerged as crucial factors for organizations to achieve sustainable growth and gain a competitive edge. This paper explores the perception of B-school students and aspiring entrepreneurs regarding the role of technology and innovation in achieving strategic advantage. A survey conducted among PGDM students at IIAM Vizag, CMT B SCHOOL, SAMATHA COLLEGE AND SRINIVASA INSTITUTE OF MANAGEMENT STUDIES revealed that they overwhelmingly recognize the importance of technology and innovation. Key findings from the survey indicate that students believe organizations should prioritize investment in research and development, foster a culture of creativity, and leverage data analytics to make informed decisions. These findings highlight the need for organizations to effectively harness technology and innovation to thrive in the ever-changing business landscape. The rapid pace of technological advancements has also led to a shift in the way businesses operate. Incubation centers and Internship opportunities to the sudents have become synonymous with growth and success in today's business environment. B-School students and aspiring entrepreneurs are increasingly focusing on leveraging emerging technologies such as artificial intelligence blockchain and big data analytics to drive innovation and gain a competitive edge.*

Keywords*: Technology, Innovation, Strategic Advantage, B-School Students, Aspiring Entrepreneurs*

V.
Energy

Investment Diversification in Green Infrastructure for Achieving Energy Independence in Nigeria

Haroon Rasheed*, S. Senthil Kumar
Skyline University Nigeria
**Corresponding Author:*

ABSTRACT: *Investment diversification in green infrastructure is increasingly recognized as pivotal for Nigeria's journey towards energy independence. This abstract explores the rationale, strategies, and potential impacts of such diversification efforts within the Nigerian context. Nigeria, a country rich in natural resources, faces significant challenges in its energy sector, including unreliable power supply and dependence on fossil fuels. The shift towards green infrastructure investment offers a promising solution to these challenges. By diversifying investments across renewable energy sources such as solar, wind, and hydroelectric power, Nigeria can reduce its reliance on traditional energy sources and mitigate environmental impacts. Key strategies include incentivizing private sector involvement through tax breaks and subsidies, enhancing regulatory frameworks to support renewable energy projects, and fostering international partnerships for technological and financial support. These strategies aim to create a conducive environment for sustainable investment in green infrastructure. The potential impacts of investment diversification in green infrastructure are manifold. Economically, it can stimulate job creation in the renewable energy sector and attract foreign direct investment. Environmentally, it can contribute to reducing greenhouse gas emissions and addressing climate change concerns. Socially, it can improve energy access, particularly in rural and underserved areas, thereby enhancing living standards and fostering inclusive development. However, challenges such as policy inconsistency, inadequate infrastructure, and financial barriers need to be addressed to fully realize the benefits of investment diversification in green infrastructure. This abstract concludes by emphasizing the urgency of adopting comprehensive and coherent strategies to harness Nigeria's green energy potential and achieve sustainable energy independence.*

Keywords*: Investment diversification, green infrastructure, Energy independence, Renewable energy.*

Optimizing Bioethanol Yield from Chemically Pre-treated Defoliated Teak Leaves

Sradhanjali Mohapatra, Ritimukta Pradhan, Lopamudra Digal, Bandita Dash, Jayashree Mohanty*
Department of Chemistry, C.V. Raman Global University, India
**Corresponding Author: j.mohanty@cgu-odisha.ac.in*

ABSTRACT: *This study analyses the potentiality of bioethanol production from chemically pre-treated defoliated teak leaves, with a focus on sustainable and cost-effective biofuel production. Addressing global challenges of environmental pollution and energy security, the research explores the viability of lignocellulosic biomass, specifically non-food plant materials, like defoliated waste leaves, for bioethanol production. Due to the abundance availability of teak leaves in India as well as in Odisha state, adequate amount of cellulose/hemicellulose, constituting total carbohydrate content, it can be a promising biomass source for producing bioethanol. Defoliated teak leaves were collected, cleaned, dried, and subjected to acid and alkali-acid pre-treatments to enhance the hydrolysis of complex carbohydrates into fermentable sugars. The fermentation process employed Saccharomyces cerevisiae, followed by distillation and ethanol quantification using FTIR and chemical analysis technique. The results indicate that teak leaves possess a carbohydrate content 39.87% making them suitable for bioethanol production. FTIR analysis confirmed significant structural modifications in the lignocellulosic biomass post-treatment, evidencing effective cellulosic hydrolysis. The combined alkali-acid pre-treatment was the most effective, yielding the highest sugar recovery, with achieving a result of 40.7%. These findings underscore the potential of defoliated teak leaves as renewable and abundant sources for bioethanol production, contributing to waste management and environmental sustainability. This research provides a promising approach to leveraging underutilized lignocellulosic biomass, thereby addressing energy demands and promoting sustainable development through bioethanol production from non-food plant residues.*

Keywords*: Teak leaves, lignocellulosic biomass, alkali-acid pre-treatment, fermentation.*

Building Sustainable Cities: A Framework for Urban Waste Management through Waste To Energy

Baishali Pradhan*
School of Planning, Architecture and Design, Sharda University, India
**Corresponding Author: Baishalipr93@gmail.com*

ABSTRACT: *Cities have experienced significant growth due to the migration of people from rural to urban areas in search of improved economic opportunities and lifestyles. However, this rapid urbanization has resulted in overcrowding, leading to a decline in the quality of urban life. One of the major challenges arising from this expansion is the increasing amount of waste generated. Effective waste management has become crucial to address environmental degradation, public health risks, and resource depletion associated with rapid urbanization. The research will focus on the issues and challenges of waste management in India. Also, Provides urban waste and presents sustainable solutions as waste-to-energy techniques. The proposed framework emphasizes a comprehensive strategy that encompasses various aspects of waste management, including resource recovery, recycling, waste reduction, and appropriate disposal. Additionally, the framework introduces a conceptual model for a centralized waste management system, which will explore the Waste to Energy.*

Keywords*: Keywords: Waste Management, Waste to Energy, Sustainable waste management, Sustainable Cities.*

Sustainable Valorisation of Madhuca longifolia Flowers: A Green Approach to MgO Nanoparticle Synthesis and Bioethanol Production with LCA Insights

Pranali I. Kurhade, Shyam M. Kodape*
Department of Chemical Engineering, Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India
**Corresponding Author: smkodape@che.vnit.ac.in*

ABSTRACT: *Madhuca longifolia (Mahua) is a notable non-timber forest product (NTFP) in India, recognized for its high sugar content and versatile applications. This study investigates a dual-purpose valorization strategy for Mahua flowers, emphasizing waste-to-resource and circular product design principles. Fresh Mahua flowers were utilized for the green synthesis of magnesium oxide (MgO) nanoparticles (NPs), leveraging their reducing sugars (≈48%) for nanoparticle formation. The synthesized MgO NPs were characterized using X-ray diffraction (XRD) to determine crystal structure, field emission scanning electron microscopy (FESEM) for morphological analysis, and Fourier-transform infrared spectroscopy (FTIR) to elucidate chemical bonding properties. Following the extraction process, the residual biomass with a remaining sugar content of ≈32% was repurposed for bioethanol production through fermentation using Saccharomyces cerevisiae (Baker's yeast). The yield of bioethanol from spent flowers reached ≈50% of that obtained from fresh flowers, demonstrating the effective management of biomass waste while enhancing the environmental footprint of the process. A life cycle impact assessment (LCIA) conducted using GaBi software quantified the environmental impacts, revealing a global warming potential (GWP) of 38.9 kg CO_2 eq. for the entire process, with the green synthesis of MgO NPs contributing 11.68 kg CO_2 eq. Significant reduction in GWP by ≈95-98% was achieved through the integration of renewable energy sources, such as solar and wind, underscoring the importance of clean energy in reducing environmental footprints. The post-fermentation solid waste, rich in nutrients, can be employed as a soil amendment, further promoting a circular economy approach. This research presents a sustainable methodology for converting excess NTFPs into high-value products, minimizing waste, and enhancing eco-efficiency, thus contributing to a sustainable waste management strategy and conservation of biodiversity. The study emphasizes the need for adopting sustainable processes that align with both environmental conservation and circular economy objectives.*

Keywords*: Green synthesis, Life cycle Assessment, Bioethanol production, MgO nanoparticles, GWP.*

Characterization of bio-oil from Indian Almond Shell and Indian Tamarind Shell Derived with the Aid of fixed Bed Pyrolyzer

Rakhesh I P*, Shenbaga Vinayaga Moorthi N
Anna University Regional Campus-Tirunelveli, India
**Corresponding Author: r.i743@ymail.com*

ABSTRACT: *Fast depletion of fossil-based fuels and related global environmental issues, present day researchers to work on bioenergy as an alternative energy fuel resource. The production and analysis of bio-oil derived from various natural resources and their usage as alternative energy source for various applications. Biomass is an economic and sustainable fuel for all people and also it is called as carbon neutral cycle. In this work, the production of bio-oil from the Indian Almond Shell and Tamarind Shell by means of a fixed bed Pyrolysis reactor is investigated. The fast pyrolysis method is considered to produce the bio oil in order to ensure high yield. The raw biomass was dried and it was fed into the reactor in powdered form. The bio-oil is extracted at the temperature in the range of 450oC to 550oC. In order to analysis the nature of biomass and bio-oil, characterization is carried out as per standards, the resultant values from biomass and bio-oil are compared with Indian Coal and Methanol, Diesel respectively. Comparison of results were interpreted in this work.*

Keywords*: Biomass, Fast Pyrolysis, Characterization, comparison, Interpretation.*

Investigation of Wasted Energy usage Approaches in Vapor Compression Refrigeration and its Performance

Biswajit Banik[1,*], Rajarshi Chakraborty[2], Sk Tanbir Islam[3], Sandip Ghosh[4]
[1]Mechanical Engineering Dept., Student of Swami Vivekananda University, Kolkata, India
[2,3]Mechanical Engineering Dept., Greater Kolkata College of Engineering and Management, Baruipur, Kolkata, India
[4]Mechanical Engineering Dept, JIS College of Engineering, Kalyani, Kolkata, India
**Corresponding Author: biswajit.banik1999@gmail.com*

ABSTRACT: *The article reviews exploratory and theoretical research in order that highlight the vapor compression refrigeration technique and its adaptations. These modifications can improve the system's performance and utilize waste energy for various purposes, including home heating, bathing, and washing, as well as large-scale industrial purposes such as manufacturing processing, diluting, and incorporating water into products, and disinfection. It might serve as a replacement for water heaters and provide hot water for all uses. It also eliminates the need for LPG gas, making it more environmentally friendly. The future concept for a vapor compression refrigeration system includes a novel design technique employing Computational Fluid Dynamics (CFD).*

Keywords*: Vapor compression, waste energy, refrigeration technique, manufacturing, Computational Fluid Dynamics.*

Valorization of Multi-Layered Edible Oil Packaging Through Pyrolysis: A Comprehensive Thermokinetic and Thermodynamic Analysis

Sudesna Aech, Pabitra Mohan Mahapatra, Achyut Kumar Panda*
Department of Chemistry, VSSUT Burla, Sambalpur Odisha, India
**Corresponding Author: akpanda_chem@vssut.ac.in*

ABSTRACT: *The disposal of multi-layered packaging, especially those used for edible oils, poses a substantial environmental issue due to their non-biodegradable properties. Pyrolysis, a thermochemical degradation process, presents a promising method for transforming this waste into valuable materials. This study explores the pyrolysis of discarded edible oil packaging, focusing on thermokinetic and thermodynamic analyses, as well as batch pyrolysis experiments. Thermogravimetric analysis was conducted at heating rates of 5, 10, 15, and 20°C/min to assess the kinetics of the pyrolysis process using both model fitting and model-free techniques, including Kissinger-Akahira-Sunose (KAS), Flynn-Wall-Ozawa (FWO), and Kissinger methods. Findings reveal a maximum weight loss of 95.9% at a heating rate of 5°C/min, with degradation following an F3 order-based mechanism, yielding an activation energy (Ea) of 291 kJ/mol and an Arrhenius factor (A) of 6.71×10^{13} min^{-1}. The average changes in free energy, enthalpy, and entropy during the thermal degradation were found to be 806.018 kJ/mol, 147.968 kJ/mol, and -876.814×10^{-3} kJ K^{-1} mol^{-1}, respectively. This research paves the way for industrial applications, process scaling, and the large-scale feasibility of pyrolysis, ultimately enhancing sustainable waste management and economic benefits.*

Keywords*: Multilayered plastics, pyrolysis, kinetic analysis, waste management.*

Constructed Wetland-Coupled Microbial Fuel Cells: A Comparative Study on Power Generation and COD Removal

Krishna Kumar Singh[1,*], Sakshi Gupta[2], Rakesh Chandra Vaishya[2]
[1]Civil Engineering, Noida International University, India
[2]Department of Civil Engineering, Motilal Nehru National Institute of Technology Allahabad, India
**Corresponding Author: krish007miet@gmail.com*

ABSTRACT: *Wastewater treatment and management using conventional methods is costly in terms of energy, operation, and maintenance, thus more cost-effective alternatives needed to address present and future issues. Hybrid built wetlands have been shown to be a beneficial technique in developing nations like India for decades due to the low costs associated with their installation, operation, functioning, and maintenance. In India, there is a significant disparity between the treated and untreated wastewater. The combination of a microbial fuel cell (MFC) and a Constructed wetland (CW) has the potential for cost-effective treatment and generation of power. Due to its potential for producing bioelectricity generation from wastewater treatment, MFC is a cutting-edge technology that is garnering attention among researchers throughout the world. This summary, while brief, is rather comprehensive. This research goes far beyond its predecessors, covering a wide range of relevant issues, including different kinds of MFCs, electrode performance, substrates, device performances, design, and technological configuration. All of these factors evaluated, presented, discussed, and the resulting information is now compiled at one place. The Constructed wetland-microbial fuel cell is a 'Green technology' that can filter wastewater while generating power. Microorganisms functioning as catalysts allow MFCs to directly convert the organic and inorganic substances found in wastewater into electricity. A proton exchange membrane separates the anaerobic anode chamber and the aerobic cathode chamber of a typical MFC. These electrons generate electricity and heat as they travel from the anode to the cathode chamber via an external circuit. This evaluation seeks to investigate future issues in the current condition of the arts for research directions based on several limited-scope works in HCW-MFC.*

Keywords*: Constructed wetland, Microbial fuel cell, Electricity generation, Coulombic efficiency, Normalized energy recovery, Municipal wastewater.*

Enhancing Circular Economies through Advanced Waste-to-Energy Technologies

G T Jyothesh Kumar[1], B.S.A. Andrews[1,*], V D N Kumar Abbaraju[1,*], P. Sunil Reddy[2]

[1]Department of Chemistry, GSS, GITAM University, Visakhapatnam, A.P, India

[2]Analytical Research and Development, Generics, IPDO, Dr. Reddy's Laboratories, Bachupally, Hyderabad, India

**Corresponding Author: sbethapu@gitam.edu*

ABSTRACT: *The increasing global demand for sustainable waste management solutions has brought Waste-to-Energy (WtE) technologies to the head of discussions on circular economies. By converting waste materials into renewable energy resources, WtE offers a dual benefit of reducing waste while providing energy. This paper investigates key WtE technologies such as anaerobic digestion and gasification and their role in advancing the circular economy model. It examines the technological, economic, and environmental advantages of WtE systems and explores the challenges they face, such as pollution concerns and technological inefficiencies. Through a detailed review of case studies and the global regulatory landscape, this paper proposes pathways for scaling up WtE technologies to contribute to a more sustainable, circular economy.*

Keywords*: Waste to Energy, Anaerobic Digestion, Gasification, Incineration and Circular Economy.*

A Scoping Study on Energy Management System in the City of Hyderabad

B. Neeraja*, B.V. Jayanthi

School of Management Studies, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad, Telangana, India

**Corresponding Author: neerajab_sms@cbit.ac.in*

ABSTRACT: *India is one of the emerging economies attracting many industries for launching their business in its land. In the present scenario of global warming and in the light of environment awareness it is an alarming issue. An important point to be observed and highlighted is regarding waste disposal and radiation produced by various industries. Industries cannot be entirely held liable because they function in reaction to customer expectations. As socially and environmentally responsible citizens, we must assist the nation by making educated decisions that encourage sustainability and ethical practices. f we are not able to produce power at least we should support to save power. The study titled A scoping study on Energy Management System in the city of Hyderabad is an initiative to identify and gain an insight into the various issues and challenges we a face due to power shortage The sensor system could prevent the unwanted usage of electricity which could be utilized for another meaningful purposes. It is advisable for the huge societies and residential complexes in the highly urbanized localities of Hyderabad*

Suggestion: This study is an attempt to provide an understanding regarding how various types of bulbs, their power consumptions and cost effective utilization of the technologies available in the market.

Findings: This will lead not only to savings on electrical bill per month for the residential associations which in turn brings down the monthly common area maintenance cost for the individual house, but also help the Government from a possible future power crisis. The findings of the study would help to acquire great knowledge about the various problems with reference to maintenance bills and solve a few problems faced by owners of residential apartments – A Win-Win scenario for both residents and associations.

Keywords*: Sensor system, Common area Lighting, Residential Complexes, Residential Associations, & Electricity Consumption.*

Performance Evaluation of Organic Rankine Cycle based Plants using Low Temperature Heat Sources

S.K. Shukla*, Saurabh Pathak, Sooraj Maurya, Bhartendu Mani Tripathi

Center for Energy and Resources Development, Mechanical Engineering Department, Indian Institute of Technology (BHU), Varanasi, India

**Corresponding Author: skshukla.mec@iitbhu.ac.in*

ABSTRACT: *The majority of industries produce low-grade thermal energy, which has traditionally been wasted due to inefficient technology. This study aims to address this challenge by developing an optimized organic Rankine cycle (ORC) power plant. The study evaluates the efficiency of two types of evaporators, namely three concentric spiral (Model 1) and two concentric spiral (Model 2) coils, in terms of their performance in a 5kW capacity system. Since low-grade thermal energy exchange is a prominent challenge in low-temperature ORC operation. R123 refrigerant is taken as working fluid. SolidWorks® and Aspen Plus® based simulation of the proposed evaporators shows that Model 1 is 15% more effective than Model 2 at optimum evaporator temperature and pressure 93 ºC, 688kPa conditions. This is validated by experimental investigation with an efficiency of 5% and power output of 2.432 kW from the expender of the ORC unit, after getting a fair agreement with less than 5% error between the simulated and experimental results for the 5kW ORC system, the 10 kW ORC system was simulated for further development. The present study would become a prerequisite for new research and pave the way for the utility of low-temperature energy sources, especially in remote areas.*

Keywords*: Waste heat recovery, Organic Rankine Cycle,RSM, Aspen plus, Heat Transfer.*

Estimation of Energy Harvest in Organic Waste Degradation

Arturo Mariano I. Figueroa*

Graduate School of Engineering, Holy Angel University, Philippines

**Corresponding Author: arturofig@yahoo.com*

ABSTRACT: *In the Philippines, as a matter of policy, the establishment of sanitary landfills is a recent development in waste management that promotes environmental protection. This indicates a gradual shift from the use of open dump sites which produce fires, smokes, and odors that pollute the air, thus embracing the use of sanitary landfills. On the other side of this approach, it is known according to the experiments of others that heat is generated in the processes occurring inside a sanitary landfill. Hence, in this experimental study, the potential energy harvest of a degrading batch of organic wastes using the basic configuration in a sanitary landfill is estimated. In this way, it introduces a new method in agricultural waste management or utilization. The specific objectives of this research are a) to design a heat absorber for solid wastes energy recover, and b) to test the performance of heat absorber in a prepared solid wastes decomposition cell. A small scale model of a sanitary landfill is developed where the subject of degradation was organic leaves. It has a capacity of 2.03 cu m. with an upper and lower soil layer sandwiching a compacted organic layer. The degradation period was observed within a period of 27 days. The energy harvesting facility is a closed system with a typical metallic heat exchanger and using water as heat transfer medium with a define flow rate. Finally, the estimated energy harvest within the observation period was computed using area under the curve method from the Time and Temperature data.*

Keywords*:*

Introduction to AI for Energy Efficiency and Sustainability

Akshara Sharma*, Nimisha Negi, Reema Thareja
India
**Corresponding Author: aksharasharma916@gmail.com*

ABSTRACT: *The incorporation of artificial intelligence (AI) into energy management systems is significantly transforming efforts toward energy efficiency and sustainability. This research provides an overview of AI applications in the energy sector, focusing on practical implementations and their implications. We examine various AI techniques, including machine learning, neural networks, and optimisation algorithms, and their effectiveness in enhancing energy efficiency across multiple sectors. Additionally, we have explored AI's role in optimising renewable energy sources. For instance, AI systems have improved the efficiency of solar panels by up to 10% through advanced predictive maintenance and real-time performance monitoring. In wind energy, AI-driven predictive models have increased turbine efficiency by 12%, leading to a higher overall energy yield. AI's optimization of energy use has also contributed to a reduction in carbon emissions, with studies showing a decrease of around 8% in greenhouse gas emissions from AI-enhanced energy systems. Furthermore, the economic impact is notable, with AI implementations in energy management yielding cost savings of up to 18% annually for businesses. The use of AI in energy management not only drives substantial improvements in energy efficiency but also supports sustainability goals through reduced carbon footprints and cost savings. This analysis underscores the transformative potential of AI technologies in addressing global energy challenges and outlines future research directions for further leveraging AI towards a sustainable energy future.*

Keywords*: AI applications, Renewable energy sources, Energy Efficiency, Optimization, Economic impact.*

Evaluating The Potential of Waste Fry Oil Biodiesel Blends for Sustainable Diesel Engine Performance and Emission Reduction

Avneet Singh[1], Gurbani Kaur[1], Adhirath Mandal[1,*], Rachan Karmakar[2], Mansi Sharma[3], Joselyn BC Toomey[2], Nikhil Ranjan Behera[2], Tripty Singh[4]
[1]Dept Mechanical Engineering, Graphic Era (Deemed to be University), Dehradun, Uttarakhand, India
[2]Dept of Environmental Science, Graphic Era (Deemed to be University), Dehradun, Uttarakhand
[3]Dept of Computer Science, Graphic Era (Deemed to be University), Dehradun, Uttarakhand, India
[4]Dept of Computer Science and Engineering, Amrita School of Engineering, Bengaluru, India
**Corresponding Author: adhirathmandal.me@geu.ac.in*

ABSTRACT: *The growing demand for fuel and the rising threat of global warming are key drivers in the search for alternative energy sources. There is increasing interest in converting waste materials into energy, as the cost of waste disposal continues to rise and much of this waste remains untreated. Many types of waste hold energy potential, particularly in the waste-to-energy (WTE) sector, which focuses on producing usable fuel from materials like used domestic waste oils (UDWOs), municipal solid waste (MSW), and agricultural and industrial waste. However, agricultural and industrial wastes are often less desirable due to their hazardous nature. In this study, waste cooking oil from restaurants was used to produce pure biodiesel through a process called transesterification, which was then blended with diesel fuel. The aim of the study was to compare the exhaust emissions of a diesel engine running on different fuels—neat diesel and biodiesel/diesel blends—at full load. The performance and emissions of a compression ignition (CI) engine were evaluated using both biodiesel and conventional diesel. Two fuel blends, B60 and B80, were tested at varying engine speeds (rpm) under full load conditions. The results showed that brake specific fuel consumption (BSFC) increased with engine speed, while brake thermal efficiency (BTE) decreased due to a less efficient air-fuel ratio at higher speeds. CO2 emissions were higher with biodiesel, attributed to its greater density and heating value, which depend on both the blending ratio and the frying time of the waste oil. The findings suggest that increasing the frying time of waste cooking oil biodiesel negatively impacts both emissions and engine performance.*

Keywords*: Alternative energy, waste-to-energy, biodiesel, transesterification, emissions.*

The State-of-the-Art in Algal Biofuel Research: Opportunities and Limitations

Rachan Karmakar[1,*], Adhirath Mandal[2], Pradeep Kumar Sharma[1], Joselyn BC Toomey[1], Nikhil Ranjan Behera[1], Krishnendu Kundu[3], Anita Rajor[4], Sourish Bhattacharya[5], Avneet Singh[2], Gurbani Kaur[2]

[1]Department of Environmental Science, Graphic Era (Deemed to be University), Dehradun, India
[2]Department of Mechanical Engineering, Graphic Era (Deemed to be University), Dehradun, India
[3]Department of Biofuel, CSIR CMERI CoEFM, Ludhiana, India
[4]School of Energy and Environment, Thapar Institute of Engineering and Technology, Patiala, India
[5]CSIR-Central Salt and Marine Chemicals Research Institute, Bhavnagar, India

**Corresponding Author: rachan.in.air@gmail.com*

ABSTRACT: *The swift urbanization and industrialization in the 20th century led to an increased cut down of fossil fuel stockpile and a surge in GHG emissions, intensifying global warming concerns. Consequently, there has been a growing focus on exploring alternative energy sources, including biofuels. Among these, algal-based fuels have emerged as a promising contender in the search for sustainable energy solutions. Algae's ability to grow rapidly and its high oil yield have drawn significant attention from researchers across the globe. In countries like the United States, considerable investments, amounting to billions of dollars, have been made to advance algal fuel research. Despite the urgent need for alternative energy in India, research in this area remains underdeveloped. Studies have shown that algal biomass holds immense potential for producing various biofuels, such as biodiesel, bioethanol, and biogas, offering a sustainable alternative to conventional fossil fuels. The development of algal biofuels represents an opportunity to reduce carbon emissions while addressing the growing demand for energy worldwide. Microbes can be applied on used algae to produce oil or biogas. But still the algal oil price is much more than it should be to become a good alternative of conventional fossil fuels. The production cost is the main reason behind its high price. In spite of that, most of the articles with economic research demands algal biofuel to be very promising. According to some research works, cut down in algal oil price may take place if some bioprocess engineering techniques get applied.*

Keywords*: Microalgae, biomass conversion, renewable energy, circular economy, carbon sequestration.*

Optimization Strategies for Sustainable Operations: A Survey-Based Study in Coal-Fired Thermal Power Plants

Mofikul Islam*

India

**Corresponding Author: profmofikulmcamba@gmail.com*

ABSTRACT: *Purpose: The study aims to use a survey of industry experts to assess the optimization strategies utilized in coal-fired thermal power plants (CFTPP). Its purpose is to identify best practices, examine their effectiveness, and, most importantly, identify potential barriers to implementation to support a long-term operational framework for meeting future energy demands while reducing environmental impact. Design/Methodology/Approach: Using a survey-based methodology, the current study will use a sample size of 251 employees from WBPDCL in West Bengal to acquire a variety of relevant information regarding the optimization tactics of CFTPP. The stratified sample will be used in the quantitative study. Findings: The empirical findings demonstrated that the integration of energy management is strongly impacted by the robustness of the energy policy. In the instance of CFTPP, better process management practices result in greater cost efficiency, while better risk management practices have a beneficial impact on the environmental consequences. This suggests that both components are mutually dependent. Conclusion: The study's conclusions represent that assessing present operational procedures and developing optimization techniques are the key to increasing the sustainability and efficiency of a coal-fired thermal power plant. The study learned by industry stakeholders serves as a reminder of the need for the study's combined efforts to lower obstacles and promote the adoption of effective and long-lasting operational reforms. Originality/Value: The present study provides valuable insights into the optimization technique for sustainable operations in CFTPP due to its unique design. In addition to integrating industry stakeholders' best practices and implementation challenges, it provides relevant and valuable recommendations for enhancing energy efficiency, cutting emissions, and advancing sustainable resource management in the industry.*

Keywords*: Sustainable Operations, Optimization Strategies, Coal-Fired Thermal Power Plants, Statistical Analysis, Quantitative Research.*

From Waste to Wonder: A Study on Turning Trash to Energy

Meera Rajeev Kumar*, Aksa Sam
Department of Public Administration, Madras Christian College, India
**Corresponding Author: aksasamt@gmail.com*

ABSTRACT: *Sustainability is the bottom-line of every initiative today. Waste management and Circular Economy though different concepts, when coupled highlights the idea of trash to treasure. Waste to Energy is a viable method that can catalyze the elimination of multiple environmental crises. Waste to Energy technology (WtE) is a head start in the Circular Economy revolution and Sustainable waste management culture. The consequences of poor waste management reflect on the economy, society, environment and health of a nation. The story takes a reverse role when there are better waste management practices. Rising population and changing lifestyle exacerbates the problems of waste management. Over 62 Million tons (MT) of waste is generated annually in India, out of which only 43 MT is collected. Only 12 MT of the collected waste undergoes treatment before disposal while the remaining huge quantity is dumped in landfills. Most of the waste generated goes untreated and unaccountable (Administration, 2023). This study examines the legislative frameworks, strategies, and policies surrounding WtE technology in India, employing a case study approach to analyze cross-sectoral initiatives that foster public-private partnerships. Several examples of Waste to Energy initiatives that promote public participation, collaboration and investment is studied. The study highlights the importance of waste management practices to yield positive outcomes across multiple sectors.*

Keywords*:*

Innovation Management of Value-Added Utilization of Municipal Sewage Sludge through Pyrolysis on Industrial Scale with the Methodology of LCA

Jozsef Kovacs*
Innovation Management Doctoral School, University of Óbuda, 1034 Budapest, Bécsi út 96/B, Hungary
**Corresponding Author: kovacs.jozsef.hwd@gmail.com*

ABSTRACT: *The reuse of municipal sewage sludge has been solved, there are many solutions for this purpose. However, the current utilization processes are limited for several reasons: the presence of complex organic polymers, microplastics, antibiotics, hormones and drug residues, hindering their use. The innovation management of value-added utilization of sewage sludge is currently being investigated but the majority of research focuses on the examination of small amounts of samples, dont considering the comparison of emissions. Despite the fact that the thermo-catalytic utilization of sewage sludge is a known and solved technology, it is necessary to compare the traditional methods (composting) of utilisation of sewage sludge with the thermolytic technology based on life cycle analysis. In the course of our objectives, we dealt with modelling and comparing the two procedures with LCA analysis. The paper aims to examine, model, and represent the potential effects of the thermo-catalytic process and composting on the environment of the processes and the products created during them. In this process, thermo-catalytic process can be applied on an industrial scale which, based on LCA analyses, has ~30% less environmental effect in terms of the microplastics, the chemical residues as well as the use of environmental resources.*

Keywords*: LCA, sewage sludge, composting, green innovation.*

Synergistic Biogas Yield from Pig Manure and Used Cooking Oil Co-Digestion

K. Wunder*, P. Satpathy, F. Uhlenhut, S. Steinigeweg
University of Applied Sciences Emden/Leer, Emden, Germany
**Corresponding Author: kerstin.wunder@hs-emden-leer.de*

ABSTRACT: *Anaerobic co-digestion has many advantages to offer, such as an improved supply of nutrients and improved process stability. Furthermore, it is advantageous to replace at least a part of the substrates with waste materials in the widely used biogas plants that are operated exclusively with renewable raw materials. This study investigates the impact of different mixing ratios of pig manure (PM) and used cooking oil (UCO) on biogas yields and emphasizes the significance of synergistic interactions between these substrates. Experiments were conducted at laboratory scale in batch reactors and different mixing ratios and comparisons were made to mono-digestions. The different ratios of lipid/carbohydrate and protein/carbohydrate were studied. PM and UCO produced 257 mL/g dry matter (DM) and 71 mL/g DM of biogas in the mono-fermentations, respectively. Synergistic effects were observed during the co-digestions, where up to 687 % more biogas was produced compared to the expected biogas production derived from the mono-fermentation experiments. It is most likely that the synergistic effect is based on an increased loading rate and more balanced nutrient composition as well as a dilution of inhibitory compounds. Understanding and harnessing these synergistic effects have important implications for optimizing anaerobic digestion systems and maximizing biogas yields. By elucidating the mechanisms underlying synergistic interactions, this study contributes to the development of sustainable waste-to-energy solutions and supports the transition towards a low-carbon future.*

Keywords*: Biogas, Pig Manure, Used Cooking Oil, Synergy, Waste-to-energy.*

Hydrogen as a Green Fuel in Indian Economy

Ashok G. Matani*
Mechanical Engineering Department, Government College of Engineering, Jalgaon - [M.S.], India
**Corresponding Author: ashokgm333@rediffmail.com, dragmatani@gmail.com*

ABSTRACT: *The use of green hydrogen will be easier in sectors which already use grey hydrogen like ammonia production, iron, but more difficult in sectors such as shipping or aviation Actually, there are a few low-carbon hydrogen projects underway or in planning stage in Egypt, Mauritania, Morocco, Namibia and South Africa. These are focused mainly on using renewables-based power to produce ammonia for fertilizer. Potential use cases include: Electricity Generation: There are two ways for using hydrogen to generate carbon-free electricity: either through fuel cells or through combustion turbines and engines. When used in a fuel cell, the only byproducts of hydrogen are heat and water vapor. When combusted like gas, hydrogen produces not only electricity but the combustion also results in nitrogen oxide (NOx), a harmful pollutant. Buildings: Since existing heating and cooking appliances can only handle hydrogen blending of 5-20 percent by volume, the use of hydrogen would not reduce emissions significantly. For hydrogen to be used in higher concentration levels, new appliances would be needed. Furthermore, hydrogen is extremely flammable, also in small concentrations. Storage of Renewable Energy: Green hydrogen could be used as a long-term storage option: In times of surplus renewable energy, additional unused electricity could be used to produce hydrogen, which would then be stored. During periods of additional demand or low renewable energy production, this hydrogen would be burned in fuel cells to generate emission-free electricity. Transport and storage: Hydrogen is less dense than gas, which makes it hard to store and requires more space than gas for the same amount of energy. Today hydrogen is most commonly stored as a gas or liquid in high-pressure tanks for small-scale mobile and stationary applications. Conclusions: Hydrogen can also be converted into a liquid for long-term storage, which requires very cold temperatures. Another option would be to convert hydrogen into liquid ammonia. Hydrogen as a fuel is a reality in countries like the United States, Russia, China, France and Germany. Others like Japan are going even further and aspire to become a hydrogen economy. Green hydrogen is becoming a key component in bringing about energy transition and ensuring a sustainable future.*

Keywords*: Clean alternatives, hydrogen economy. renewables-based power to produce ammonia for fertilizer.*

Effect of Microwave Radiation on Synthesis of Methylcellulose from Sugarcane Bagasse

Malini Buvaneswaran, Sinija V R*
National Institute of Food Technology, Entrepreneurship, and Management (NIFTEM-T), Thanjavur
**Corresponding Author: sinija@iifpt.edu.in*

ABSTRACT: *This study analysed the effect of microwave radiation on the preparation of methylcellulose from sugarcane bagasse. Cellulose was extracted from sugarcane bagasse using the hydrogen peroxide bleaching method, and its quantity and purity were analysed` using the TAPPI method. For methylcellulose preparation, the extracted cellulose was treated using microwave radiation at three different power levels (270 W, 360 W, and 450 W) for four different treatment times (120s, 180s, 240s, and 300 s). Dimethyl sulfate was used as a methylating agent, the microwave-treated samples were compared with conventional synthesis of methylcellulose. The methylcellulose's degree of substitution (DS) was analysed using the Zeisel method and FTIR spectra. The yield of methylcellulose from cellulose ranges from 65 to 75%. In all samples, the presence of -CH stretching in FTIR spectra confirmed the methylation of cellulose. The effect of various treatment parameters (microwave treatment time and power) on DS, methoxy content, and solubility of methylcellulose were optimized using a Central Composite Design. A significant increase in DS of methylcellulose was identified in microwave-treated samples, the highest DS was observed at the power level of 450 W. The conventional sample has a solubility of 29% in water (at 25℃), while the solubility of microwave-treated samples ranges from 25% to 65%. The DS and solubility of methylcellulose in water have a linear relationship. The required DS and methoxy content of methylcellulose were observed at 450 W for 240 s of microwave radiation. This study highlights the application of microwave radiation for the synthesis of methylcellulose.*

Keywords*: Methylcellulose, Sugarcane bagasse, Microwave radiation, FTIR, Solubility.*

Enhanced Phosphorus Capture from Manure Waste Streams through Thermal Pre-treatment and Modified Biochar/Hydrochar Adsorption

Tao Zhang*
College of Resources and Environmental Sciences, China Agricultural University, Beijing, China
**Corresponding Author: taozhang@cau.edu.cn*

ABSTRACT: *In the contemporary era, the depletion of phosphorus resources emerged as a significant environmental and agricultural challenge, emphasizing the need for innovative and sustainable recovery strategies. Phosphorus, an essential element for agricultural productivity, is present in large amounts in animal manure, a byproduct of extensive livestock and poultry farming. Recognizing this, the recovery of phosphorus from such organic waste not only mitigates the impending scarcity but also aligns with global food security objectives. Among the innovative approaches being explored, the thermolysis process, which converts agricultural waste into biochar or hydrochar, stands out. Due to their distinctive porous structures, these materials offer a promising approach for phosphorus sorption, addressing the critical need for efficient recovery techniques. However, this process presents challenges; the presence of organic phosphorus, sparingly soluble phosphorus, and other compounds significantly complicates solubilization and selective recovery efforts. To address these challenges, our research focuses on optimizing thermal pretreatment processes to improve the bioavailability of phosphorus. Through strategic modifications, biochar and hydrochar have been engineered to effectively capture phosphorus and facilitate its gradual release in soil environments, enhancing their utility as sustainable fertilizers. This dual functionality highlights the potential of modified biochar and hydrochar to contribute to the circular economy, reinforcing the crucial role of advanced recovery technologies in achieving sustainable development goals.*

Keywords*: phosphorus; manure waste streams; biochar; hydrochar; sustainable waste management.*

Municipal Solid Waste Management: Waste to Energy Potential in Thirumangalam Municipality, Madurai, Tamil Nadu, India

Jancy Rani J, Vijayakumar G, Piruthivi Raj S , Revathy S R* , Kirubakaran V
Centre for Rural Energy, Gandhigram Rural Institute – DTBU, India
**Corresponding Author: revathysrajaram@gmail.com*

ABSTRACT: *Municipal Solid Waste (MSW) has become a greater challenge in India with the increase in population, change in consumption patterns, and rapid urbanization. According to the Central Pollution Control Board, only 28% of the waste is recycled. This study focuses on exploring the waste-to-energy potential of the MSW to promote sustainable waste management and circular economy with a focus on a case study from a specific municipality in Tamil Nadu. The primary focus of this study begins with the analysis of the MSW generation, segregation, and existing infrastructure for collection, transport, and treatment at the Thirumangalam, Municipality in Tamil Nadu. As a part of the study, MSW samples were collected from the region and their physical and chemical properties were evaluated through experimentation. The technical feasibility, economic viability, and environmental impacts of the various waste-to-energy conversion processes for the selected municipality are discussed. The key findings reveal that the municipality's MSW composition supports a substantial energy recovery potential through anaerobic digestion and gasification. The data and physical observation of the sites suggest that 100% source segregation is achieved at the source and the municipality has an excellent secondary segregation unit, which is highly advantageous. However, significant barriers such as a lack of technical expertise or skilled workforce and a lack of investment in advanced waste-processing facilities were identified as the existing gap in the WTE process. Suitable solutions and strategies to incorporate WTE facilities in the Municipality are proposed based on both quantitative and qualitative analysis; which when implemented will serve as a model municipality for other regions in the state to adopt sustainable practices.*

Keywords*: Municipal Solid Waste, Waste to Energy, Anaerobic digestion, Gasification, Sustainability..*

Opportunities for Renewable-Energy-Coupled Desalination in India: A Path Forward

A. Gowtham[1], S. Kuladeep[2], S. Udaya Keerthi[2], Ch. Anil[1,*]
[1]Department of Chemical Engineering, ANITS, Visakhapatnam, India
[2]Department of Mechanical Engineering, Andhra University College of Engineering for Women, Visakhapatnam
**Corresponding Author: chitturianil@gmail.com*

ABSTRACT: *As freshwater scarcity intensifies across India, with over 163 million people lacking access to safe drinking water, desalination has emerged as a viable solution for augmenting water resources. India's water demand is projected to reach 1.5 trillion cubic meters by 2030, surpassing the available supply, which underscores the urgent need for alternative solutions. However, conventional desalination methods are energy-intensive, requiring approximately 3-5 kWh of energy per cubic meter of freshwater produced, and heavily reliant on fossil fuels, which account for over 70% of India's energy mix. This reliance poses significant economic and environmental challenges, as it contributes to high greenhouse gas emissions and volatile operational costs. Integrating renewable energy technologies with desalination presents a promising opportunity to achieve sustainable freshwater production while reducing carbon emissions. Solar and wind energy, with potential capacities of 749 GW and 302 GW in India, respectively, offer abundant resources for powering desalination systems, particularly in coastal and arid regions where water stress is highest. This paper explores the potential of renewable-energy-powered desalination in India. By highlighting both the challenges and transformative potential of renewable-energy-coupled desalination, this paper aims to contribute to India's progress toward sustainable water resource management, aligning with national goals for climate resilience and resource conservation.*

Keywords*: Desalination, renewable energy, energy, economics and environment.*

Assessment of Energy Recovery Potential from Plastic Waste Through Pyrolysis

Sirapa Chitrakar[1],*,Bikash Adhikari[1], Rabindra Prasad Dhakal[2]

[1]Department of Environmental Science and Engineering (DESE), Kathmandu University, Nepal

[2]Nepal Academy of Science and Technology, Nepal

**Corresponding Author: s irapac124@gmail.com*

ABSTRACT: *Plastic has many advantages and has become an essential part of modern life, but its disposal has become a significant issue. The amount of plastic waste is increasing, and only a small percentage of it is properly recycled. This study assesses the potential of pyrolysis as a method for energy recovery from plastic waste. Specifically, it seeks to determine the energy recovery potential in the form of pyrolysis oil from different types of plastic waste, including High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), Polypropylene (PP), and Polystyrene (PS), sourced from municipal solid waste (MSW) in Lalitpur Metropolitan City, Nepal.To address this, plastic waste samples were collected, sorted, cleaned, and processed through pyrolysis at 420°C for three hours. The dependent variables include the volume of pyrolysis oil produced, while the independent variable is the type of plastic used. Proximate analysis was conducted to measure moisture content, volatile matter, fixed carbon, and ash content. This study indicated that Plastic Solid Waste (PSW) had an average contribution of 20.40 % in the Municipal Solid Waste(MSW) of Lalitpur Metropolitan City. HDPE had the highest average portion of 41.55% and PS had the least at 3.77 %, whereas PET contributed 7.17%, PVC contributed 7.13%, LDPE contributed 17.39 %and PP contributed 16.62 % on average. The pyrolysis process yielded different amounts of crude oil for each plastic type, with HDPE producing 0.594 L/kg, LDPE yielding 0.67 L/kg, and PP yielding the highest with 0.77 L/kg from cement bags. PS produced the least oil, 0.55 L/kg. In terms of mixed plastic, the ratio containing the higher ratio of LDPE produced the highest volume of crude oil of 0.426L/Kg, and the ratio containing the highest amount of HDPE produced the lowest volume of crude oil of 0.336 L/KgThe calorific values of the oil produced ranged from 6,738 to 9,285 Cal/gm, with PP having the highest value.*

Keywords*: Plastic waste, Pyrolysis, Energy Recovery.*

Bioenzyme to Biogas: An integrated approach to boost green gas production from sweet sorghum stalks by pretreating with citrus bioenzyme

Yashika Aggarwal, Urmila Gupta Phutela*

Dept. of Renewable Energy Engineering, Punjab Agricultural University, Ludhiana, Punjab, India

**Corresponding Author: urmilphutela@pau.edu*

ABSTRACT: *Biogas production from lignocellulose-rich residues via anaerobic digestion by diverse microbial communities has proven an effective approach for managing agricultural waste left after crop cultivation. Sweet sorghum, mainly a fodder crop, is widely regarded as an ideal biofuel feedstock due to its balanced mix of soluble and insoluble carbohydrates. However, its high lignin content and the highly polymerized, crystalline cellulose structure limit its digestibility, necessitating pretreatment to increase cellulose accessibility for enhanced microbial or enzymatic breakdown. This study aims to boost biogas production by biologically pre-treating sweet sorghum stalks with bio-enzymes. Citrus fruits account for roughly 14% of all fruit crops, yet around 50–60% of processed citrus comprising peels, pulp, and seeds becomes waste. Therefore bioenzymes in this study were produced by the anaerobic fermentation of citrus (mosambi) waste combined with jaggery and water in a 3:1:10 ratio, utilizing diverse indigenous microflora in 50-liter HDPE (High-Density Polyethylene) drums. Bioenzyme thus produced was used to pretreat sweet sorghum stalks in different concentrations and 10% bioenzyme for 4 days exhibited maximum reductions of approximately 33.83% in total solids, 3.55% in volatile solids, 17.06% in hemicellulose, and 19.51% in cellulose, with lignin reduced by 16.23% compared to untreated samples. Lab-scale biogas production tests in 2-liter digesters revealed a significant improvement in biogas yield in 90 days, from 17.64 L/kg in untreated stalks to 169.12 L/kg in bioenzyme pretreated stalks. Therefore, mosambi-based bioenzyme proves to be a cost-effective and eco-friendly solution for enhancing biogas production from various organic wastes.*

Keywords*: Sweet-sorghum, biogas, pretreatment, bioenzymes, fermented.*

Extraction, Characterization & Emission Evaluation of B20 Biofuel from Chicken Fat Waste

Karthik S B*
India
**Corresponding Author: karthik-me@dsu.edu.in*

ABSTRACT: *This project focuses on extracting biodiesel from chicken waste, specifically chicken skin a significant source of solid waste often left unutilized. Waste chicken skin, sourced from local poultry farms, was processed to extract oil, which was subsequently converted into biodiesel through transesterification. Biodiesel produced in this way can be used as a standalone fuel or blended with petroleum diesel. Key benefits of biodiesel include its non-toxic nature, biodegradability, and low emissions. Karnataka alone slaughters 4–5 lakh chickens daily, generating approximately 350 tonnes of waste. Poultry waste also presents environmental challenges, such as unpleasant Odors and attracting flies and rodents, as seen in Nigeria. Typically, poultry waste is disposed of by burning or dumping. Experiments were conducted to stabilize poultry waste over 12 weeks using a bag method akin to static pile composting, with and without amendments like sawdust or leaves. Sawdust proved most effective for producing a well-stabilized, environmentally safe product. Additionally, composted waste, even with leaves alone, showed no adverse effect on maize yield when applied at 20 tonnes per hectare after 8–12 weeks.*

Keywords*:*

Assessing The Sustainability of Waste-To-Energy Solutions: Converting Waste into Power

Ar G Rajeshwar Rao*, Sushant. J, Damarla Sai Puneeth
School of Architecture and Planning, Woxsen University, Hyderabad, Telangana, India
**Corresponding Author: rajeshwar.rao@woxsen.edu.in*

ABSTRACT: *The worldwide waste predicament presents pressing ecological and financial problems that are leading to governing bodies and entrepreneurs to learn cutting-edge waste management systems, such as the waste-to-energy (WtE) technique. WtE, as an innovative alternative way of waste management that produces energy during the waste disposal, is highlighted in this paper as one of the possible sustainable approaches, where its environmental, economic, and social impacts are discussed. This paper reviews the different WtE processes such as incineration, gasification, and anaerobic digestion in evaluating the benefits and drawbacks of each technology with respect to efficiency, emissions and energy recoverability. According to results, WtE can supplement efforts to divert waste from landfills and to mitigate greenhouses gases alongside existing practice when implemented with modern emissions control and efficient energy recovery. Nevertheless, WtE will only work as an efficient sustainable solution when coupled with adequate waste separation, government support, and measures to address waste generation on a larger scale. The paper demonstrates the WtE opportunities to embrace a circular economy with global suggestions on how policies and technologies could strengthen sustainability of the WtE and receiving communities. Waste-to-Energy can contribute to waste management and energy production, its sustainability depends on carefully addressing emissions, economic feasibility, public health concerns, and policy support. For WtE to be a truly sustainable solution, it must complement recycling and reduction efforts, process only non-recyclable waste, and incorporate advanced emission-control technology.*

Keywords*: Waste Minimization, Emissions Control, Resource Recovery, Economic Viability, Environmental Impact.*

Chiller Sustainability: With Predictive maintenance strategies for long term energy & cost savings

Subramaniam MR*, Saisree Mangu
GITAM, School of Business, Bengaluru, India
**Corresponding Author: smurugap@gitam.in*

ABSTRACT: *Chiller systems play an important part in maintaining optimal temperatures in different industrial and commercial environments. However, they present notable difficulties because of their substantial energy use and operating expenses. This study focuses on the significance of predictive maintenance solutions in improving the sustainability of chillers by diminishing energy consumption and decreasing long-term costs. The introduction emphasizes the significance of chillers in contemporary infrastructure and the urgent need for energy-efficient solutions. The aim of the research is to evaluate the influence of predictive maintenance on the energy efficiency and cost reduction of chiller systems. The systematic literature review evaluates the current body of research on predictive maintenance, emphasizing its capacity to enhance energy efficiency and cost-effectiveness in chiller operations. The process is doing a quantitative study using SPSS software, with data obtained from organizations that have adopted predictive maintenance on their chiller systems. The research posits hypotheses to investigate the impact of predictive maintenance on energy consumption, cost savings, and the life of system. Data analysis centres on the use of statistical tests, such as ANOVA and Chi- square test, to assess the efficacy of these tactics. The conclusion shows that the use of predictive maintenance greatly improves the long-term viability of chillers by optimizing energy usage and decreasing operating expenses. These results emphasize the significance of implementing predictive maintenance in the chiller sector, offering useful information for firms aiming for long-term sustainability and efficiency. This study adds to the expanding pool of information on sustainable practices, providing practical suggestions for enhancing the efficiency of chiller systems while reducing their environmental footprint and operating costs.*

Keywords*: Chiller Sustainability, Predictive Maintenance, Energy Efficiency and Cost Savings.*

Transformative potential of integrated gasification in municipal solid waste management in New Delhi: A material flow analysis approach

Rahul S Raj[1], Siddharth Jain[1],*, Amit Kumar Sharma[2]
[1]Department of Mechanical Engineering, UPES, Dehradun, India
[2]Engines and Biofuels Research Laboratory, Department of R&D, College of Engineering Studies, UPES, Dehradun, India
**Corresponding Author: siddharth.jain@ddn.upes.ac.in*

ABSTRACT: *New Delhi faces critical challenges in managing its municipal solid waste (MSW) of approximately 11,300 tons per day (tpd), which primarily ends up in overflowing landfills such as Ghazipur, Bhalswa, and Okhla. Current conventional routes, involving recycling, composting, and incineration, direct 5,510 tpd to landfills, of which only 3,690 tpd is converted to useful products while 3,907 tpd accumulates as waste stock in the landfill, leaving a substantial environmental burden. This study utilizes material flow analysis (MFA) via STAN software to assess the potential impact of transitioning to thermochemical conversion, specifically integrated gasification, for improved waste management. Findings indicate that with gasification, 6,427 tpd of MSW could be converted into usable outputs, an increase of 74% in product yield compared to conventional methods while landfill contributions drop to 2,457 tpd (a 55% reduction). Additionally, stock in landfills decreases to 1,782 tpd, significantly lowering environmental impacts and enhancing resource recovery. These results underscore integrated gasification as a transformative alternative, with substantial reductions in landfill requirements, enhanced carbon conversion efficiency, and lower emissions. This paper will detail the comparative metrics, demonstrating gasification's capacity to support sustainable urban waste management in New Delhi.*

Keywords*: Thermochemical Conversion, Municipal Solid Waste, Material Flow Analysis, Substance Flow Analysis, Waste to Energy.*

Energy Efficient Stocks and Exchange Rate Dynamics: Evidence from Indian Stock Market

Chandrabhanu Das[1,*] , Renuka Lenka[2]

[1]GITAM School of Business GITAM Deemed to be University, Hyderabad Campus, India

[2]GITAM School of Business GITAM Deemed to be University, Vishakapatnam Campus, India

**Corresponding Author: chandrabhanudas80@gmail.com*

ABSTRACT: *This article investigates dynamics between stock returns of energy efficient firms and exchange rate in India. The study considers Bombay Stock Exchange (BSE) thematic indices BSE Greenex to represent energy-efficient firms and BSE Oil and Gas with firms as listed oil suppliers for comparison. Results indicate the existence of flow flow-oriented approach between energy portfolio and exchange rate. The study finds policy implications for central bank intervention in energy consumption.*

Keywords*: energy efficiency, exchange rate.*

Toward a Sustainable Energy Future: E-fuels and Their Role in Reducing Greenhouse Gas Emissions

Z I Tawfik, S T El-Sheltawy*, A R Abdelghany

Chemical Engineering Department, Faculty of Engineering, Cairo University, Egypt

**Corresponding Author: dr.shereenkamel@hotmail.com*

ABSTRACT: *As the global energy landscape transitions towards carbon-neutral solutions, electrofuels (e-fuels) have gained attention as a promising option to decarbonize challenging sectors, including aviation, maritime, and heavy-duty transportation. These synthetic fuels are produced by utilizing renewable electricity and captured CO2, positioning them as crucial contributors to reducing greenhouse gas emissions. This study investigates the production processes of different e-fuel types, including hydrogen-based and alcohol-based fuels such as e-methanol, while examining their compatibility with existing energy infrastructures. A comprehensive analysis of the technological pathways and carbon emissions reduction reveals the efficiency of e-fuels, especially in addressing the intermittency of renewable energy sources. The study also assesses the environmental benefits of blending e-fuels, particularly hydrogen, with natural gas to further lower carbon emissions. While the results indicate significant potential for e-fuels in contributing to a sustainable energy future, the need for continued advancements in production scalability and economic viability remains critical for their widespread adoption.*

Keywords*: E-fuels, electrofuels, decarbonization, renewable energy, hydrogen-based fuels, alcohol-based fuels, energy storage, carbon emissions, synthetic fuels, power-to-gas*

Integrating 3D Immobilized Microbial Consortium on Activated Carbon Systems by Biohydrogen Production For Greener Future

Raveena Jayam. J, K.J. Sharmila*

Department of Biotechnology, Dr M.G.R Educational and Research Institute, Chennai, Tamil Nadu, India

**Corresponding Author: sharmila.ibt@drmgrdu.ac.in*

ABSTRACT: *Water and soil resources are severely contaminated by the untreated or improperly treated wastewater released by the leather tanning industries. An effective degradation of real TE was attained by a newly developed bacterial consortium within 120 h with 80.32, 82.14, 74.68, 51.42, 74.61, 63.23, 70.42, 85.42% reduction in pollution parameters such as COD, BOD, TDS, phosphate, sulphate, nitrate, Cr,phenol. ICP-OES, HP-LC, FT-IR, and GC–MS study showed that most of the organic contaminants identified at 7 pH, 0.5 % glucose and ammonium chloride, 130 rpm, and 15 mL inoculum volume. A study was conducted to investigate the effects of alginate and chitosan as encapsulating agents on biofilm formation and microbial adhesion to activated carbon, with the goal of enhancing biohydrogen production.The experiment involved five separate batch fermentations in a bioreactor, maintained at 60°C and pH 6.0. The optimal hydrogen production rate (HPR) of 2.47 ± 0.47 mmol H_2/L•h and a hydrogen yield of 2.09 ± 0.22 mol H_2/mol sugar were achieved using an Alg concentration of 2 g/L. The GAC-AlgC beads yielded an HPR of 0.93 ± 0.05 mmol H_2/L•h and a hydrogen yield of 1.11 ± 0.35 mol H_2/mol sugar at a chitosan concentration of 2 g/L. The toxicity of bacterially treated TE was significantly reduced, allowing the 75% germination of seeds.This method improves microbial adhesion and colonization, resulting in consistent hydrogen production rates even at elevated temperatures, thus offering a promising strategy for biohydrogen production.the newly developed bacterial consortium demonstrated a remarkable potential to efficiently treat/detoxify leather TE for environmental safety.*

Keywords*: biohydrogen production, 3D immobilised cells, tannery effluent, phytotoxicity, bioremediation, Degradation*

Converting University Bio-Waste into Energy: A Practical Model for Biomass Gasification and Utilization

Raja Kumar Bollem, C Harihara Thanay Reddy*, Udit Chhajer, S. Sai Akshay Sriram, Dr. VVK Lakshmi, M Venkata Maheswara Patrudu

Gitam Deemed to be University, Venture Development Centre, India

**Corresponding Author: hcattama@gitam.in*

ABSTRACT: *This action research focuses on the practical application of biomass gasification at the university level, aiming to convert bio-waste into usable energy within a circular economy framework. By adopting an existing downdraft gasifier design, the project utilizes approximately 1,200 kg of dry leaf waste collected daily from the university premises, converting it into syngas for heat 003production. This study emphasizes real-time applications, measuring the quantity of heat produced and its utilization efficiency within the campus. The research also rigorously monitors the carbon emissions produced during the gasification process, enabling the assessment of gasifier efficiency and its environmental impact. Through these measurements, the project aims to optimize energy output while minimizing carbon emissions, offering a sustainable alternative to conventional waste disposal and energy generation methods.The project's core focus is on understanding how biomass waste can be converted into valuable energy, providing a renewable heat source that can be integrated into the university's energy system. By utilizing bio-waste on-site, the research supports the circular economy model, where waste is repurposed to reduce reliance on fossil fuels and contribute to sustainable resource management. This work also provides insights into scaling gasifiers for institutional applications, determining the optimal size for universities based on waste generation and energy needs. The project fosters clean energy, sustainable practices, and responsible resource management, while offering a practical model for waste-to-energy solutions in educational institutions. Aligned with Sustainable Development Goals (SDGs) 7 (Affordable and Clean Energy), 11 (Sustainable Cities and Communities), and 12 (Responsible Consumption and Production), the project demonstrates the feasibility of implementing biomass gasification as a low-carbon energy solution, contributing to sustainability and responsible resource consumption.*

Keywords*: Biomass Gasification, Circular Economy, Waste-to-Energy, Sustainable Energy, Carbon Emission Control*

Enhancement of Heat Pipe Heat Transfer by Using Recent Advanced Working Fluids For Sustainable Energy Applications

P. Prabakaran, P. Kalidoss, M. Karthikraja*

Mechanical Engineering, Dhanalakshmi Srinivasan University - Trichy - India

**Corresponding Author: karthikmechmo@gmail.com*

ABSTRACT: *This current work deals with the role of advanced working fluids used with the heat pipe in sustainable energy applications such as solar energy systems, thermal energy storage, waste heat recovery systems, and geothermal energy production systems. Heat dissipation is the prime work in sustainable energy applications, which involves Produced unwanted heat must be carried away from the system and stored as energy to convert as useful energy. Most of the time produced heat would reduce the life time of the components, so they need to eradicate the formation of heat through that, enhancing the performance of the system. Different preparation methods, thermophysical property enhancement techniques, and characterization techniques were employed to improve the performance of the advanced working fluid. These enhancements of working fluids lead to better heat transfer coefficient, low thermal resistance, and high thermal performance, and these are all the essential performance improvement factors. The advanced working fluids need to be used to improve the thermal performance of the other applications, such as aerospace, microelectronics, automobiles, RAC, and electronics. The better heat transfer performance achieved by the MWCNT fluids compared to water was due to their having more than 10 times better thermal conductivity, low density, and low viscosity, while the two-step method is the best process to prepare the perfect nanofluid, and the better performance obtained by the filling ratio was 40 to 70% and the effective concentration of the nanofluids was better than others.*

Keywords*: working fluids, thermo physical properties, heat pipe, MWCNT, thermal performance*

Sustainable optimization of data processing waste in distributed systems: addressing energy consumption and electronic waste in data-intensive application

Priti Bharambe, Ashwini Satkar*, Vikas Mahandule, Kavita Mahajan
MIT Arts, Commerce & Science College, Alandi, Pune, India
**Corresponding Author: asatkar@mitacsc.ac.in*

ABSTRACT: *Today distributed systems are widely implemented in fields like financial, medical, electronic commerce, telecommunication and many more. However, these systems are very influential to major environmental problems such as energy wastage and E-waste. Specifically, this paper seeks to develop ways of minimizing environmental concerns of Distributed Systems as energy consumption, duplicate processing of data, and e-waste management. The study assesses the effectiveness of energy optimization algorithms, method and techniques for green disposal of wastes, and data handling, management to enhance resource utilization in various distributed systems. Efficiency measures like how to balance computing workloads, using Circularity principles for managing the hardware, and a more efficient use of energy to run the computers are examined. This research relies on theoretical frameworks in addition to simulation studies in order to explain the effects of these strategies in the context of system performance. Altogether, the results obtained for system energy consumption and e-waste show the effectiveness of these techniques in enhancing the efficiency of distributed systems. The outcomes support system designer's hypothesis about decrease of environmental footprint with no detriment of efficiency. The result of this study can be insightful to system designers and policy makers as it presents avenues that can be taken to incorporate energy efficiency and sustainability in architectures and functioning of distributed systems. In this paper, new ideas are introduced to the stream of sustainable computing as to how carbon footprint can be minimized and resources conserved while dealing with large volumes of data.*

Keywords*: Distributed Systems, Energy Consumption, Waste Management, Sustainable Optimization, Data Processing Efficiency.*

VI.
Environmental Aspects and Impacts - Climate Change, Global Warming & Protection

Carbon Mineralization and Global Warming Potential of Poultry Litter Biochar and Raw Poultry Litter Amendments in Acidic Paddy Soil

Anjali T.B, Anand Madhavan*
School of Environmental Studies, Cochin University of Science and Technology, Kochi, Kerala, India
**Corresponding Author: anandm@cusat.ac.in*

ABSTRACT: *The carbon sequestration potential of poultry litter biochar (PLB) is determined by its native soil carbon mineralization. The potential carbon mineralization (PCM) and global warming potential (GWP) must be evaluated before the long-term field supplementation. The present study monitors PCM and GWP of poultry litter, poultry litter biochar, and conventional farming methods in paddy soils of Kunnukara village, Kerala. The paddy soils were incubated in the dark at 25oC for 120 days after amending supplements and later follow-up CO2 emissions. The treatment T5, that is, PLB prepared at 350oC for 30 minutes residence time, has a maximum carbon dioxide emission reduction ranging from 0.0408 to 0.0042 mgCO2-C/g soil and a minimum cumulative CO2-C release of 58.72mg/kg. T5 also exhibited the lowest GWP of 0.000251 kg CO2 /kg. The treatment T6, following the conventional farming method, exhibited the lowest CO2 emission reduction (0.0410 to 0.0220 mgCO2-C/g) and the highest cumulative CO2-C release of 146.87 mg/kg, as well as the highest GWP of 0.000539 kg CO2 /kg soil. Further, PLB exhibited a negative priming effect after 15 days of incubation. The PCM values are worthy that the application biochar prepared at 250, 300, and 350oC for 30, 60, and 30 minutes showed carbon dioxide emission reduction compared to raw poultry litter. The carbon mineralization was found to be increasing at the beginning of incubation while gradually decreasing after 15-30 days of incubation. The feedstock poultry litter had significantly higher carbon mineralization and GWP.*

Keywords*: Poultry Litter Biochar; carbon sequestration; potential carbon mineralization; and global warming potential.*

Balancing Industrial Growth with Environmental Responsibility

Naadir Kamal*
Department of Computer Science, Dr. C.V. Raman University, Vaishali, Bihar, India
**Corresponding Author: naadirkamal@gmail.com*

ABSTRACT: *It all started in 1780 with the Industrial Revolution, which culminated to its next level- Electrification (1870), Automation (1970) and so on into Digitalization (2011) and beyond; soon we have Personalization (2020) written over it. All of these have resulted in remarkable strides forward for industrial development. But the exponential rise in the number of factories has contributed historically high rates of waste which is why top brass decided to promote sustainable manufacturing as well. That is why Industry 4.0 and the newer Industries 5.0 have changed manufacturing, waste processing, recycling with high-tech automation integration. Internet of Things (IoT) and data analytics enable Industry 4.0 to better optimise operations, reduce waste as well improve recycling strategies with the issuance of real-time information on how best treatment starts can be employed. This is taken one step further in Industry 5.0, which sees additional human-centric methods and sustainable practices develop more harmonious relationships between humans and machines while achieving efficiencies through robotic assistance (and artificial intelligence) to eliminate waste; all with the purpose of ensuring these new technologies work on behalf of people – not just producers or profit above natural resource limitations. Moreover, the growing dependence on green and sustainable power sources is of high significance to drive eco-friendly production processes. It aligns perfectly with the trend towards sustainable energy and reduces manufacturing ecological footprints whilst promoting resilient & responsible industrial practices.*

Keywords*: sustainable manufacturing, industry 4.0, IoT, AI, green power source.*

Community-Driven Environmental Conservation: The Case of Berhampur Sabuja Bahini

M Dillip Kumar*
India
**Corresponding Author: brahmapursabujabahini@gmail.com*

ABSTRACT: *Berhampur Sabuja Bahini (BSB) is a non-governmental organization founded in 2014 with a mission to protect and nurture the environment through community-driven efforts. Operating predominantly in Ganjam district, Odisha, BSB has initiated and executed numerous campaigns focused on afforestation, waste reduction, and ecological conservation. Our work revolves around sustainable practices, such as tree plantation drives, water body rejuvenation, and eco-friendly festival celebrations. A key aspect of our mission is public engagement, where we involve children, women, social work organizations, and educational institutions in our initiatives.*
Among our notable campaigns are the "Adopt a Tree Drive," where people commemorate personal milestones by planting and adopting saplings, and the "Brukhya Heen Jibono (Trees Are Life)" program, which promotes the celebration of festivals like Holi, Raksha Bandhan, and Ganesh Chaturthi in eco-friendly ways by integrating nature conservation. Additionally, the "Seeds for Forest" campaign turns discarded seeds from household waste into valuable resources for reforestation. We also focus on blood donation drives, such as the "Let's Build a Blood Relation" campaign, which encourages young donors to contribute to local blood banks, particularly during crises like the COVID-19 pandemic. Our efforts have led to the plantation of over 1000 saplings, the collection of more than 5000 units of blood, and the creation of a database of over 1200 active donors. Despite financial constraints, we continue to grow through a dedicated team of volunteers and a small subscription model. Through our work, we aim to demonstrate that grassroots movements and community participation can significantly contribute to sustainable environmental conservation. By participating in the 14th International Conference on Sustainable Waste Management, we hope to share our experiences, learn from global best practices, and expand our impact.

India's Path to Net Zero: A Journey through the Nifty Fifty Companies

Hema Doreswamy, Anita Pillai, Radhika Uttam*
Prin L N Welingkar Institute of Management Development and Research, Bengaluru, India
**Corresponding Author: radhika.uttam@welingkar.org*

ABSTRACT: *The United Nations climate change conference, COP 28 (Conference of Paris), was held at Dubai, UAE, from 30th November 2023 to 13th December 2023. The event registered around 85000 participants, which included heads of state, government representatives, civil society representatives, research scholars, students, the business community, youth, philanthropists, social entrepreneurs, climate change activists and so on. COP 28 was a significant event as it concluded the global stocktake of the world's efforts towards actions/decisions on climate change under the Paris Agreement. The first global stocktake highlighted the slow progress and the urgent need for more stringent and effective measures from all stakeholders to accelerate the journey towards achieving the goals of the Paris Agreement. This underscores the urgency and importance of these measures in the fight against climate change. At COP 2026, held in Glasgow, the Indian Prime minister announced that India will achieve net zero emissions by 2070. India has also updated its NDC (Nationally determined contributions) in August 2022. According to this, the emission intensity of GDP will increase to 45% by 2030, and non-fossil-based energy resources out of total installed capacity will be enhanced to 50% by 2030. These targets are very ambitious and will require all stakeholders to aggressively pursue measures to achieve the targets set by the government. The corporate sector, particularly manufacturing and production units, plays a pivotal role in climate change action. These entities have the potential to significantly contribute to controlling all three types of emissions – scopes 1, 2, and 3. Their active participation is not just beneficial but also a responsibility in the fight against climate change. In this study, researchers will examine corporate disclosure with reference to GHG/CO2 emissions, energy efficiency and waste management for Nifty Fifty companies. The data will be collected from the Bloomberg terminal and analysed sector-wise. Appropriate statistical tools will be used to bring out meaningful inferences from the data collected.*

Harnessing Cyber-Physical Systems for Forest Conservation: Preserving Green Cover and Habitat Biodiversity

Manikandan MK Manicka*
CHRIST (Deemed to be University), Bengaluru, India
**Corresponding Author: manikandan.mkm@christuniversity.in*

ABSTRACT: *Cyber-Physical Systems (CPS) have the potential to bring about significant change in forest conservation. They offer new ways to monitor, manage, and protect forest ecosystems by combining physical processes with computational algorithms for real-time data collection, analysis, and automated responses.*

Real-time monitoring involves the use of sensors, drones, and satellite imagery to keep track of forest health, identify illegal logging, and assess environmental changes. Early threat detection systems utilise machine learning to recognise potential risks such as wildfires, pest outbreaks, and encroachment. Precision forestry is employed to optimise tree planting, monitor growth, and ensure sustainable harvesting, all aimed at efficient resource use and minimal environmental impact." CPS technologies like camera traps, acoustic sensors, and GPS tracking enhance wildlife protection by monitoring animal movements and habitat conditions, thus aiding in the conservation of endangered species. To engage local communities, interactive maps, mobile apps, and data visualisation platforms are used, empowering them to participate in conservation efforts and report observations.

This paper seeks to underscore the importance and influence of CPS in advancing sustainable forest management. It presents successful implementations and explores emerging trends, highlighting the critical role of CPS in preserving forests and maintaining biodiversity.

Keywords*: Cyber-Physical Systems, Forest Conservation, Wild Fires, Precision Forestry, Sustainable Harvesting.*

Comparative Analysis on Coverage of Climate Change and Waste Management in The Guardian and The Times of India

Suruchi Agrawal*, Agya Ram Pandey*
Department of Mass Communication, Galgotias University, India
**Corresponding Author: suruchi.agrawal96@gmail.com, aram.pandey@galgotiasuniversity.edu.in*

ABSTRACT: *This study represents a corpus-based comparative analysis on coverage of climate change and waste management in The Guardian and The Times of India during the year 2023. This research paper mainly focuses on representation of waste and its impact on climate through coverage pattern in both the newspapers. For this the study utilizes the software 'Antconc' for textual analysis and for analysis the researcher further on explores the framing and frequency of waste management related issues in context of climate change.*

This research paper aims to emphasize on waste as a critical factor in degradation of our environment through coverage pattern in both the newspapers. The outcome will provide insights into how the leading newspapers in UK and India uncovers the discourse on waste management and climate change and how the issue is prioritised at global level in addressing major environmental challenges.

Keywords*: Climate Change, Waste Management, Media Coverage, Newspaper Analysis, Environmental Degradation.*

Mitigating Environmental Impacts through Modal Shifts: A Life Cycle Assessment of India's Freight Transport Infrastructure

Krishna Murthy Inumula[1,*], Misbah: Misbah Hayat[2]

[1]Symbiosis Institute of International Business (SIIB), Symbiosis International (Deemed University) (SIU), Pune, India
[2]Asian Paints Ltd., India

**Corresponding Author: dr.krishna@siib.ac.in*

ABSTRACT: *This research emphasizes analyzing existing transport logistics systems of the state, detecting problems within every mode of transport, and proposing solutions for them to advance towards the sustainable development of multimodal logistics. It also looks into how the nation's logistic infrastructure can be optimized, and challenges associated with shifting from one mode of transport to another within the Indian transport system are considered as such changes are deemed necessary to remedy the structural imbalance. Ex-ante and ex-post evaluations of the funding strategies were carried out as life cycle assessments using Open L.C.A. software and eco-invent database, which concluded that the new modal infrastructure would be less damaging when utilized than the one that is presently available. Building rail shipments share of the total to 45% would significantly mitigate the adverse effects on the environment that the current structure of the modalities of freight transport. In addition, it was found that, hence why the changes were made, the displacement of transportation brought down global warming impacts by a commendable 9%, as well as the impacts of emissions in ecotoxicity in the land, ocean and freshwater by 20% on average. These results highlight the need to boost rail traffic and build railway infrastructure as the most efficient strategy towards positive outcomes. The research admits some data-sourced weaknesses, but it contributes to appreciating the need to put in place an appropriate transport system that is environmentally sound for the country's anticipated development.*

Keywords*: Environmental impact, Life cycle assessment, Eco-friendly transportation and Sustainable logistics.*

Experimental and Theoretical Investigation on EAHE-SC Coupled System for Indoor Air Conditioning

D Arunkumar[1], R Murugan[2,*]

[1]Dept. of Mechanical Engineering, Madanapalle Institute of Technology and Science, A.P, India
[2]Dept. of Mechanical Engineering, Panimalar Engineering College, Varatharajapurm, Chennai, India

**Corresponding Author: profmuruganpit@gmail.com*

ABSTRACT: *Applying a hybrid cooling technology to reduce the domestic cooling demand would give both environmental and economic benefits. Heat energy available below the earth surface could be tapped by earth to air heat exchanger (EAHE) system by means of the pipes buried under the ground. As the unconditioned air flows into the pipes, due to the difference in temperature among the air and the soil, the air inside the pipe is heated during the winter and cooled during the summer seasons. By utilizing this free energy, the power demand required for space conditioning can be lowered in dry climate areas. In the present study, an attempt is made to reduce the energy usage for air conditioning of a building situated in the southern part of India by employing an EAHE system coupled with Solar Chimney (SC). First EAHE system has been designed and developed to formulate a hypothetical model to predict the temperature of the outflow air. The 24 m length pipeline of EAHE system comprises 5.7 m PVC pipe and 18.3 m aluminium pipe considered in this research provides cooling of 3–7 °C for the considered air velocity range of 1m/s to 5 m/s. To enhance the cooling and ventilation of the room further, the EAHE has been combined with SC. For the preferred solar collector inclination of 37.5o and height of 0.7 m, enhanced heat transfer of 400 W and efficiency of 36.91% are attained. The SC helps to achieve the necessary air change range as per ASHRAE standard. The observed analytical results were compared to the experimental results of the proposed design and it shows fair consent. The findings of the present study offer the basic information of coupled system and adoptability of combined EAHE-SC system to attain the indoor solace.*

Keywords*: Earth to air heat exchanger (EAHE), solar collector, air temperature, ventilation, air change hour, indoor comfort.*

Comparison of flat Slabs with and without drops under different Seismic Zones using Etabs

Mahmad Irfan*, Nayana B S, Harshil S G
Department of Civil Engineering, The Oxford College of Engineering, Bangalore, India
**Corresponding Author: nayanabs31@gmail.com*

ABSTRACT: *We all know that Flat Slab is a type of slab in which Beams are not present in the structure. The Load is transferred directly to columns from the slabs. An extended part of slab called as Drop is provided to resist the Shear. Flat slab is an economical slab when compared to conventional slabs. A substantial amount of material is preserved. The goal of this effort is to put together a cross-section of structural parts that can meet the IS stability requirements. A level section is a form of reinforced slab of concrete used in building construction. It is distinguished by its simplicity, as it lacks beams or girders between columns, resulting in a flat and uninterrupted ceiling surface. In a level section design, the slab immediately spans between the columns, allowing for a clean and flexible space layout within the building. A level section is a sort of structural system used in buildings in which Without the need of beams, the slab is supported directly by the columns. It has a smooth, open internal area, making it popular for commercial and residential building. To protect the building's security in seismic regions with a high earthquake risk, additional safety measures must be performed. In places with low to moderate seismic activity, level slabs can commonly be utilized without drops, which are thicker sections of the solid object surrounding the columns to increase load-bearing capability. The present research examines level slabs with and without drops utilizing Dynamic Analysis in seismic zones iii and iv using the ETABS 2017 programme. This research looked at four different models. Two zone iii models and two zone iv models, with and without drops, respectively. We concluded from static and dynamic analysis of these models that are in zones iii and iv with drops had less storey displacement, storey drift, and less time lapse than structures in zones iii and iv without drops respectively.*

Keywords*: Flat slab, Drop.*

Building a Resilient Bharat: Earthquake-Resistant Steel Frames and Environmental Conservation

Padmakar Maddala*
Department of Civil Engineering, Vignan's Institute of Information Technology, Duvvada, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: padmakarmaddala@gmail.com*

ABSTRACT: *Steel structure has been crucial to the construction industry in recent decades. A structure must be designed with strong seismic performance in mind. The current Indian code (IS 800 -2007) is followed in the design of a multi-story steel frame building's seismic performance. Steel bracings can be added to the structural system to boost the structure's shear capacity. Retrofitting can also be done with bracings. Steel bracings, such as D, K, and V type eccentric bracings, can be arranged in an infinite number of ways. According to IS 800-2007, a typical six-story steel frame building is intended for different kinds of eccentric bracings. According to IS 800-2007, a typical six-story steel frame building is intended for different kinds of eccentric bracings. The many kinds of eccentric bracings that are taken into consideration for this study are D, K, and V. Every frame's performance is examined using nonlinear static analysis.*

Keywords*: Pushover analysis, Steel frames, Bracings, Behaviour factor.*

A Case Study on the Role of Social Entrepreneurs in Promoting Environmental Sustainability

Achanta. Rajyalakshmi*, K. Sreekanth
GITAM Hyderabad Business School, Hyderabad, India
**Corresponding Author: a.rajyalakshmi@nift.ac.in*

ABSTRACT: *This study investigates the key role of Social Entrepreneurs play in driving social innovations that advance environmental sustainability. Utilizing a qualitative case study approach, this research delves into the practices of five exemplary social Entrepreneurs—Ecokaari, Kalla, Sutrakaar, Green Sole, and Phool.co. The above firms have successfully recycled waste to create quality products which are sought after the environmentally conscious customer. These Entrepreneurs were selected through purposive sampling due to their innovative operations and significant recognition for contributing to sustainable social change. Data was collected through in-depth interviews with key stakeholders the study discovers the motivational factors that inspire these social entrepreneurs, the entrepreneurial journeys they embarked upon, and the myriad of supports and challenges they encounter in managing their social enterprises. The analysis further examines how these enterprises contribute to environmental sustainability, thereby aligning with and promoting sustainable development goals (SDGs). The research underscores the importance of innovative practices in the design, development, and utilization of products and services to achieve meaningful environmental impacts. By highlighting these practices, the study showcases the diverse strategies employed by social enterprises to tackle environmental challenges and drive social change. It offers both theoretical and practical insights, shedding light on the mechanisms through which social innovations are implemented by social entrepreneurs. Additionally, the study emphasizes the crucial role of social entrepreneurs in advancing a sustainable future, calling for ongoing support and recognition of their efforts in promoting environmental sustainability.*

Keywords*: Social Enterprises, Environmental Sustainability, Social Innovations, Sustainable Development Goals (SDGs).*

Mango Waste Impact on Soil Physiochemical, Biological and Enzymatic Activities

N. Sai Jyothi[1,*], G. Narasimha[2], S. Anitha[1]
[1]Department of Biotechnology, Sri Krishnadevarya University, Anantapuramu, Andhra Pradesh, India.
[2]Deparatment of Virology, Sri Venkateswara University, Tirupati, Andhra Pradesh, India
**Corresponding Author: anithasku@gmail.com*

ABSTRACT: *Soil is the basic and significant resource, which provide anchorage and nutrients for the plant growth. It forms the dynamic system affecting the terrestrial ecosystem, by providing the direct or indirect flow of energy, inorganic and organic matter. Soil holds nutrients and water obtained from the decaying organic and inorganic matter and supports the whole life on earth. That is each living organism either primitive or the highly evolved depend on the soil for food directly or indirectly. Direct discharge of industrial and domestic waste into soil with or without the treatment, have profound effect on its physical, chemical and biological properties. Soil fertility is affected with the pollutants can be restored with the microorganisms. Microorganisms with their enzymes like cellulases and amylases present in soil play a vital role in the restoration of the soil properties. In the present investigation, Soil samples were collected from the polluted and non-polluted regions in and around the industries of mango pulp discharged areas. Mango effluents containing soils are little acidic, but higher mineralization has turned this condition in favor of other soil parameters. The contents of clay, organic matter, total nitrogen and electrical conductivity are relatively higher in soil with mango effluent discharges than in the control soils. The enzyme activities of cellulases and amylases was found to be increased, and this in turn increased the growth of plants. Plants easily assimilated nitrogen and phosphorus in high quantities. Fungal population increase in these soils was also profound with increased nuritent contents.*

Keywords*: Soil properties, mineralization, mango waste, cellulase and amylases.*

The Influence of Waste Products of Arsenic Industries on Soil Pollution in Racha-Lechkhumi and Kvemo Svaneti Regions

L. Shavliashvili*, G. Kuchava, M. Tabatadze, E. Shubladze.
Institute of Hydrometeorology of Technical University of Georgia, Georgia, Tbilisi
**Corresponding Author: n.dvalishvili@gtu.ge*

ABSTRACT: *In the region of Racha-Lechkhumi and Kvemo Svaneti, arsenic ore mining, processing and production of arsenic-containing compounds have been going on for many years. In the villages of Uravi and Tsana, a large amount of toxic waste left over from the production of arsenic from the Soviet period is stored in the territory of the Samtochemical factory. Currently, both deposits are conserved, but the problem is arsenic-containing waste and soil contamination of the areas surrounding the former factories.The purpose of the research is to create a map of the arsenic contamination of the region's soils to identify the vulnerable points of contamination, where phytoremediation biotechnology will be implemented for soil reclamation. Soil sampling points were selected from polluted, agricultural, recreational and background sites at 0-5 and 5-20 cm soil depth. The total form of arsenic was determined in the collected soil samples. The level of arsenic contamination of the soils in the areas surrounding the arsenic processing enterprises of Racha-Lechkhumi and Kvemo Svaneti region has been identified.Analyzes were carried out using modern methods and equipment that correspond to European standards. It was obtained according to the following: the soils of Uravi-2 in Ambrolauri municipality and Tsana-1 in Lentekhi municipality are the most contaminated with arsenic; 30 at-risk soil sampling facilities were identified, where the hazard index (HQs >1) due to high arsenic concentrations; Based on the received data, a map of arsenic contamination of the soils of Racha-Lechkhumi and Kvemo Svaneti region was drawn up in the GIS system.*

Keywords*: Arsenic contamination, Waste products, Soils, Hazard Index, Contamination map.*

Assessment of Tourism and Recreational Resources in the Context of Climate Change in Georgia

Liana Kartvelishvili*
Institute of Hydrometeorology of Georgian Technical University, Georgia, Tbilisi
National Environmental Agency of Georgia, Georgia, Tbilisi
**Corresponding Author: natelaananiashvili@yahoo.com*

ABSTRACT: *Today it is impossible to make the right decisions without taking into account environmental conditions. The natural fluctuations of the climate have negative impact on the environmental area; One of the issues facing humanity is the climate change, to which UN summits are periodically dedicated. Georgia has been actively involved in the implementation of the UN Framework Convention on Climate Change since 1996. Our team participated in all convention focusing on tourism and climate issues.WTO considers that climate forecasts to become extremely important for sustainable development of tourism all over the world. Among key components of tourism recreation potential are climate resources. WMO and WTO adopted first resolution on the need for assessment of tourism recreation potential in tourism regions of member countries in 2010. Georgia is full member of both organizations (WMO & WTO), which preconditions the need for the assessment of tourism recreation potential. This article discusses the impact of climate and its changes on the development of the tourism sector in Georgia. To evaluate tourism-recreational resources in Georgia for the first time several Tourism Climatic Indexes should be used, based on the combination of different climatological elements. The data of different climatic stations were taken from the climatic database "CLIDATA" of the National Environment Agency of Georgia to calculate the tourist indices. On the basis of the obtained data, correct decisions should be made when designing tours in different climatic zones against negative climatic events. For the development of ski-tourism it is important to take into account the aspects of climate change. That is why twenty years for the period (I .1961-1985 and II. 1986-2010) were estimated according to the law of change in the strength of snow cover in several mountain-skiing areas.*

Keywords*: Climate change, Tourism Climatic Index, Glacier recession, World Tourism Organization (WTO), Natural resources, Tourism industry, Ski tourism.*

Truck Turnaround Time and Impact on Environment

Chunchu Aravind Sowmitri*, Y L P Thorani
Gitam School of Business, India
**Corresponding Author: aravindsowmitri@gmail.com*

ABSTRACT: *While there are various comprehensive strategies tailored to reduce truck TAT effectively, there are several factors which have small impact in TAT individually but collectively have huge impact which when not monitored and acted against can lead to situations creating huge impact on TAT. There is inadequate solution addressing these multifaceted challenges. There is often focus on singular aspect rather than holistic approaches. This leaves room for a comprehensive framework that focus on all aspects of turn around process. Often the problem in the distribution leads to stoppage of production. The approach is to get primary data of variables affecting TAT and get to the root cause of the variables and give suggestions on improving/ solving the variables to reduce the TAT. Daily truck samples are taken for quantitative data analysis and interview with management for qualitative data analysis and finding the loopholes/ shortcomings in the existing system. Truck touch points are Entry, LEP (lorry entry permit), 1st weighment, loading, 2nd weighment, waybill/exit, Standard TAT time is found to be around 4 hours, actual TAT is around 6 hours. Complex working environment where there is clash with rake and road loading, preference is given to rake loading as there is accumulation of penalty and the company moves 75 to 80% of daily turnover by rake, Daily production is 4000 tones, Loading and weighment are taking more than standard time required. This has huge environmental and resource implications as there is unnecessary movement of materials and trucks, Communication is important and we could save lot of resources, if there was proper and immediate communication between parties and respective departments and impact on environment is also reduced.*

Seasonal Variation in Ambient PM2.5 Concentrations and Implications for Public Health in Accra, Ghana

Enoch Akyeampong[1,*], Courage Daneku[1], Benson Owusu[2], Isaac Kwabla Agbenyezi[1], Kingsley E. Amegah[3], Michael Affordofe[1], Charles E. Amankwa[5], Ernest Twum[1], Richard Amfo-Otu[4]

[1]Accra School of Hygiene, Korle-Bu, Ghana
[2]Central University, Prampram, Ghana
[3]University of Cape Coast, Cape Coast, Ghana
[4]University of Environment and Sustainable Development, Somanya, Ghana
[5]University of North Texas Health Science Center, USA

**Corresponding Author: enaf.enoch@gmail.com*

ABSTRACT: *Introduction: Elevated levels of air pollutants (PM2.5) are reported to be prevalent in cities in sub-Saharan Africa (SSA) with significant public health consequences. This study analyzed seasonal variation in ambient PM2.5 concentration in six cities in Ghana and its implications for public health. Methods: We utilized secondary gravimetric (filter-based) particulate matter (PM2.5) data from 2020-2022 to provide wide-array of data on air pollution variations in the rapidly evolving city of Accra, Ghana. Data for the dry and wet seasons from six Environmental Protection Agency monitoring points across the city were used. Results: The median concentration of PM2.5 was greater in 2020 at the Mallam Market in the dry season (113.89 (92.42 – 125.69 µg/m3)) than in the rainy season (81.59 (75.69 – 105.32 µg/m3)). Conversely, the concentration of first light in 2021 during the rainy season (178.82 (106.94 – 229.17 µg/m3)) far exceeded that in the dry season (120.83 (111.57 – 149.31 µg/m3)). There was a significant difference in the median PM2.5 concentration in 2022 at Tantra Hill between the dry season and the rainy season (188.35 ±18.77 µg/m3 vs 147.34 ±32.61 µg/m3, p=0.017). PM2.5 was more than three times lower in 2020 (-29.2 µg/m3, p=0.032) at Graphic Road than in 2020 (2022, -111.5 µg/m3, p<0.001) in the rainy season relative to the dry season. Conclusion: The PM2.5 concentrations in both seasons were unacceptably greater than those recommended by the National Air Quality Guideline (35 µg/m3). Efforts to reduce PM2.5 levels in urban cities in Ghana and SSA should include vehicular emission compliance.*

Keywords*: Particulate matter, seasonality, public health, air quality, Greater Accra.*

Green and Clean Program to Address Environmental Damage (Study in Semarang, Indonesia)

Reza Allifia Annaz, Naili Ni'matul Illiyyun*
Department of Sociology, Faculty of Social and Political Science State Islamic University Walisongo
**Corresponding Author: naili.illiyyun@walisongo.ac.id*

ABSTRACT: *Urban environmental problems usually occur due to several factors such as urbanization, poverty, and land conversion. The equitable development in the city of Semarang emphasizes infrastructure to realize the smart city concept, which needs to be balanced by considering environmental conditions. Environmental damage that occurs, such as air pollution, damaged roads, and a lack of green spaces due to their conversion into residential areas. This research aims to understand the efforts in addressing environmental damage and the impact of the Green and Clean Program. The research method used is qualitative research with a field research type. This research employs a narrative approach and structural functionalism theory by Robert King Merton. The research data collection technique uses participatory observation and unstructured interviews. The results of this research show that the people of Bandungsari village engage in environmental greening activities and cleaning the environment to prevent environmental damage. For greening activities such as planting trees and utilizing yard space. Moreover, environmental cleaning activities such as providing trash bins according to their types, organic and non- organic, disposing of waste in its proper place, and recycling waste. The impact of the green and clean program is the increase in public awareness of the environment and a driver of sustainable development.*

Keywords*: Environment, green and clean program, PKK, environmental damage.*

Climate change and oil palm plantations: Is it sustainable

Agamutu Pariatambya*, Bristi Khatunb
Jeffrey Sachs Center on Sustainable, Sunway
**Corresponding Author: agamutup@sunway.edu.my*

ABSTRACT: *The rapid expansion of oil palm plantations across Southeast Asia, Africa, and Latin America, now covering around 30 million hectares, poses urgent sustainability challenges. Indonesia and Malaysia alone produce 85% of the world's palm oil, driving significant environmental impacts such as deforestation and peatland drainage. In 2023, deforestation for plantations in Indonesia increased by 36% to 30,000 hectares, with one-third of this on carbon-rich peatlands, releasing substantial greenhouse gases. Since 1990, palm oil expansion has contributed to 10% of global rainforest loss and 12% of annual carbon emissions. This deforestation also threatens biodiversity, with over 50% of species in palm-growing regions at risk due to habitat destruction. Recent trends show a shift, with 68% of palm oil producers committing to zero deforestation as of 2023. The European Union's new regulation banning imports linked to deforestation, which affects an estimated $6 billion in palm oil trade, is already influencing sustainable practices in producing countries. Despite these shifts, palm oil remains economically crucial for Indonesia, Malaysia, Nigeria, and Colombia, supporting over 4.5 million jobs in Indonesia and Malaysia alone, primarily for smallholder farmers who produce 40% of the global supply. However, social issues such as land disputes and labor rights abuses persist, impacting around 25% of smallholders. Achieving sustainability in palm oil requires enforcing zero-deforestation policies, better land-use planning, and developing more resilient varieties. Supporting smallholders in sustainable practices, coupled with fair labor standards, remains essential. International collaboration, stricter regulations, and fair trade policies are critical for balancing economic gains with environmental and social responsibility.*

Keywords*: Palm oil, deforestation, biodiversity loss, greenhouse gas emissions, sustainable practices.*

Barry University's Continued Commitment to Sustainability

Anita Závodská*
Department of Biology, Barry University, USA
**Corresponding Author: azavodska@barry.edu*

ABSTRACT: *Barry University, a private Catholic institution in south Florida, was founded on Adrian Dominican principles. One of the university's commitments is to preserve the sacredness of the Earth. In the past, the university embedded environmental sustainability in many daily operations and campus activities, in addition to including it in its curriculum. As of 2023, the university has also officially signed on to commit to the promotion of sustainability in a more official way – by committing to the challenge set forth by the Pope's encyclical Laudato si'. The university has formed a Laudato si' committee which is made up of four working circles that are charged with the promotion of sustainability on campus. These circles are: the campus sustainability circle, the student formation and engagement circle, the awareness and professional development circle, and the community impact circle. Each of these circles approaches sustainability from a slightly different direction and the goal is that all of the individual objectives of the different circles will work together to significantly increase the university's sustainability standing. In the presentation, the author will share details about the Laudato si' committee and its four circles.*

Keywords*:*

Can Food Waste Reduction & Reutilization Help Reducing Campus Carbon Footprint?

Serpil Guran*
Rutgers EcoComplex, 1200 Florence-Columbus Road, Bordentown NJ, 08505 USA
**Corresponding Author: Serpil.guran@rutgers.edu*

ABSTRACT: *Increased impacts and further risks of climate change is forcing countries, institutions and companies to find solutions. Higher education institutions are also identifying actionable items that integrates critical thinking and climate action into academic research, teaching, outreach, engagement, campus life, and university policy across campuses. Climate change mitigation efforts include reducing the carbon footprint of institutions by building overall a culture of sustainability including reducing fossil energy consumption through power and transportation, improved buildings, reduced water consumption, and efficient waste management. Efficient food waste management involves efficient source separation, recycling and reutilization in achieving a circular economy framework. This work presents the findings of cafeteria food waste source separation, diversion from landfills and composting impact on reducing campus carbon footprint and estimated CO2 equivalent emissions reductions to the atmosphere. The compost quality also represents that campus cafeteria waste could serve and efficient feedstock in displacing fossil and/or mineral based fertilizers. Additionally, this work summarizes the importance of living laboratory.*

Keywords*: food waste, climate change mitigation, decarbonizing campuses, composting.*

Sustainable Steel: Innovations and Opportunities for Reducing Carbon Footprint

Raktim Dasgupta[1,*], Sadhan Kumar Ghosh[2], Arup Ranjan Mukhopadhyay[3]

[1]JadavpurUniversity, Department of Mechanical Engineering, Kolkata, India
[2]DG, SD&CE research centre, ISWMAW, Former, Jadavpur University, India
[3]Indian Statistical Institute, SQC&OR Division, Kolkata, India

**Corresponding Author: raktimdasgupta3@gmail.com*

ABSTRACT: *The steel industry, which employs over six million people and generates almost USD 2.5 trillion in revenue annually, is a significant contributor to the Indian economy. India is currently the second-largest producer and consumer of steel in the world. The output of crude steel grew at a compound annual growth rate of 5.7% between 2020 and 2023. Global rivalry, high energy consumption, and environmental concerns are some of the major obstacles the sector must overcome. India must move towards sustainable methods, including carbon capture, renewable energy, and green hydrogen in order to meet its goals of net-zero emissions by 2070 and a 33–35% reduction in carbon intensity by 2030. This article explores the manufacture of steel in India using blast furnaces (BF), basic oxygen furnaces (BOF), electric arc furnaces (EAF), and direct reduced iron (DRI), as well as other energy sources like coal, biomass, and natural gas. A case study and statistical methods are used to determine the optimal combination that achieves a balance between economic viability and environmental sustainability. To identify the optimal combination of current energy sources and technologies in the Indian context, the PROMETHEE technique is employed. Additionally, an optimization algorithm is utilized to reduce production costs and Scope 1 and 2 emissions. An innovative integrated framework that blends optimization algorithms with the PROMETHEE approach is presented in this paper, enabling a thorough evaluation of energy sources and steel manufacturing technologies tailored to India's unique economic and environmental context.*

Keywords*: Carbon capture and storage, Scope 1 & Scope 2 Emission, scrap recycling, PROMETHEE, Sustainable steel, Geometric Optimization.*

Assessing the impacts of solid waste on air quality in urban areas of Visakhapatnam: A case study

Deepthi Murapala, Srinivas Namuduri, Suresh Kumar Kolli*

GITAM School of Science, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: skolli@gitam.edu*

ABSTRACT: *The increase in urban civilization has resulted in a rise of solid waste generation, and improper management of solid waste leads to environmental menace such as water, soil and air pollution creating human health hazards. In the present research, it is evident that the open burning of solid waste elevates the pollution levels of the air in urban areas of Visakhapatnam by releasing harmful pollutants into the atmosphere. A quantitative estimation by Principal component analysis–multiple linear regression (PCA–MLR) model indicated that solid waste dumping is also a prime source of the major contributors of Particulate Matter concentration in ambient air. Solid waste dumping contributes about 36% of PM concentration generation in residential areas. This present work focuses on solid waste issues associated with air pollution and impacts on public health from emissions generated from various waste management practices, such as emissions from automobiles, industries, dust from construction sites, roadways, and open waste burning, which contribute to air quality deterioration in the urban areas of Visakhapatnam. The sampling areas are located in 10 km radius of the major dumping yards in the city, including Kapulauppada, Marikavalasa- a Solid waste transfer unit. The analysis of emission data underscores the importance of adopting sustainable waste management strategies, including waste-to-energy technologies, composting techniques, recycling, public awareness, and innovations in waste processing technologies, which play a vital role in achieving sustainable waste management effectively.*

Keywords*: Sustainable waste practices, Particulate Matter, Environmental Pollution, Urbanization, Air Quality*

Assessment of heavy metal concentration and source identification in ambient air and their implications for solid waste management in developing areas of Anakapalli District, Andhra Pradesh, India

Jagadeeswara Rao K, Nyayapathi Priyanka Priyadarshini, Suresh Kumar K, Srinivas Namuduri*

GITAM School of Science, GITAM Deemed to be University, Visakhapatnam, India

**Corresponding Author: snamudur@gitam.edu*

ABSTRACT: *Ambient air quality, which refers to the air surrounding us is significantly influenced by various factors, including natural phenomena like wildfires and emissions from industrial and vehicular activities. Monitoring this quality is crucial for assessing health risks associated with pollution and for implementing regulations to safeguard both the environment and public health. This paper presents an analysis of the ambient concentration of trace metals in PM10 within an industrialized coastal region, highlighting the identification of emission sources related to solid waste management. The samples were collected on quartz filters using respirable dust samplers, with trace metals in PM10 analyzed via ICPMS. Chemical characterization revealed that exposed land deposition and road dust are major contributors, with trace metals such as Zn, Fe, Cu, Mn, Cr, Pb, and others exhibiting elevated levels due to industrial activities. The analysis of enrichment factors indicated that anthropogenic sources have resulted in a substantial increase in metal concentrations. PCA further suggested that the primary sources of PM10 include traffic emissions, biomass, and burning solid waste in industrial processes. These findings underscore the critical need for improved solid waste management strategies to mitigate air pollution and enhance public health outcomes. Addressing the emissions from solid waste incineration and improper waste disposal practices will be essential in reducing the concentration of harmful trace metals in the atmosphere. By implementing effective solid waste management practices, the ambient air quality and improve human health.*

Keywords*: Source apportionment, Ambient air quality, Solid waste Management, Heavy metals, Particulate Matter.*

Environmental Impact of Upcycling vs. Downcycling: A Comparative Study of Waste Management Techniques in the Built Environment

Anjana J Nair*, Gagan Jain

SoAP, Woxsen University

**Corresponding Author: anjana.nair@woxsen.edu.in*

ABSTRACT: *This paper examines the roles of upcycling and downcycling in waste management and sustainable architecture. It provides a comprehensive analysis of these strategies, comparing their environmental impacts, contributions to the circular economy, and economic benefits. The study explores innovative applications of upcycling and downcycling in architectural projects, highlighting their potential to reduce waste, conserve resources, and enhance sustainability in the construction industry. Key metrics for assessing environmental impact, including carbon footprint, energy consumption, and waste diversion rates, are discussed. The paper also addresses the challenges and limitations of implementing these practices, such as design constraints, economic feasibility, and market acceptance. Case studies of successful upcycling and downcycling projects in architecture are presented, demonstrating their practical applications and benefits. The findings suggest that while both strategies contribute to waste reduction, upcycling offers greater potential for creating high-value products and aligning with circular economic principles. The paper concludes by emphasizing the need for further research and innovation to enhance the effectiveness of these processes in promoting environmental sustainability and economic growth in the construction sector.*

Keywords*: Waste management, Sustainable architecture, upcycling, downcycling.*

Implementing Green Infrastructure for Waste Management Solutions: A Path to Urban Sustainability

Gagan Jain, Anjana J Nair*
SoAP, Woxsen University
**Corresponding Author: anjana.nair@woxsen.edu.in*

ABSTRACT: *This research paper explores the implementation of green infrastructure for waste management solutions in urban environments. It addresses the limitations of traditional waste management methods and highlights the urgent need for innovative solutions to tackle the global waste management crisis exacerbated by rapid urbanization. The study examines the potential of green infrastructure to provide ecosystem services, enhance urban sustainability, and improve waste management practices. It presents a comprehensive analysis of the benefits and challenges associated with green infrastructure implementation, drawing on case studies and empirical evidence from various urban contexts. Key findings highlight the multifaceted benefits of green infrastructure, including improved air and water quality, enhanced biodiversity, and increased urban resilience. The paper also discusses economic advantages, such as job creation and property value increases, as well as social benefits like improved public health and community cohesion. The research employs a mixed-methods approach, integrating qualitative and quantitative data to evaluate the environmental, economic, and social impacts of green infrastructure projects. It also assesses current policies and regulations influencing green infrastructure adoption and identifies key research gaps in the field. The study concludes with policy recommendations and best practices for urban planners and policymakers to effectively implement green infrastructure strategies, contributing to sustainable urban development and addressing pressing waste management challenges.*

Keywords*: Green Infrastructure, Waste management, urban sustainability.*

Urban heat island mitigation through waste-conscious architectural design

Damarla Sai Puneeth *, Ravi Kumar S, Gagan Jain
School of Architecture and Planning, Woxsen University, Hyderabad, Telangana, India
**Corresponding Author: saipuneeth.damarla@woxsen.edu.in*

ABSTRACT: *Urban Heat Islands (UHIs) threaten cities around the world by affecting humans, energy use and urban liveability. It, therefore, investigates what architectural design with attention to waste could mean in facilitating a more innovative perspective for designing out UHIs by responding to the urgent issue of construction and demolition waste. This study explores the relationship among sustainable architecture, circular economy strategies, and urban heat mitigation based on an extensive literature review and case study analysis.The analysis looks at different waste-sensitive design methods that involve repurposed and local materials, passive design alternatives, and active technologies, for example, green rooftops and cool pavements. It also considers urban planning elements, specifying the role of the green networks and integrated drainage and water management strategies on UHI mitigation. The study presents examples of these strategies embedded in architectural practice demonstrating their usefulness in urban temperature mitigation and as devices for further waste-centric sustainable urbanisation.In addition, in this paper, there are challenges and barriers to implementing these strategies, including economic constraints, regulatory hurdles and technical limitations. Finally, it outlines future research trends in the area, including advancing technologies and design policies that will promote increased adoption of design for waste considering low-UHI mitigation.In applying the principles of waste management in the context of urban heat island (UHI) mitigation, this research adds to the existing literature on sustainable urban design. Thesis The results highlight the promise of waste-oriented strategies in advancing climate resilience, sustainability, thermal comfort, and adaptation at the urban neighbourhood scale and provide recommendations for architects, urban planners and policymakers alike.*

Keywords*: Urban Heat Island (UHI), Waste-Conscious Design, Sustainable Architecture, Circular Economy, Climate Change Mitigation*

Religious doctrine as an approach for attaining ecological balance leading to sustainability

Sunil Belladi*

Symbiosis Centre for Media & Communication Symbiosis International (Deemed University) Pune, India

**Corresponding Author: besunil@hotmail.com*

ABSTRACT: *Current scholarship on climate change, global warming, sustainability has and continue to warn us that, the direction various nations have engaged under the pretext of so called development have done more damage than good to the environment. This is no new fact that, unprecedented urbanization, harsher over exploitation of natural resources has affected the quality of beings, and throwing humanity into disorder. The present study makes a critical analysis on how Buddhist Economics can be employed in restoring the ecology. The study banks on the theoretical framework informed by the concept of Posthumanism, that acknowledges; agency is only distributed to humans through forces beyond their control and they entirely are entangled and dependent on nature and the environment. And in the process, the paper sets out to provide a swift rundown on the present state of ecological crisis and the immoral ecological practices across the globe and its antagonistic history. To find a riposte is to start anew a vital dialogue about embracing the 'Buddhist Economics' as labelled and advocated by E.F. Schumacher in his work, Small is Beautiful. 2500 year before the Kyoto Protocol, Buddha discoursed on how to live a harmonious life encompassing compassion and right livelihood. As Buddha goes on to state, "you are your own master", the Shakyamuni just shows us the path, Dhammapada. For the Global South there is no better time than now, to take a cognizance, appreciate, and realize and the nuggets offered by the wisdom informed by Buddhist Economics and promptly adopt the philosophy for a noble cause – to safeguard the Gaia. Even the 'Superman' as envisaged of Friedrich Nietzsche cannot bail us out of this ecological misadventure. We require to turn over an environmental leaf by embracing and practising Buddhist Economics not just in addressing the climate emergency that is staring humanity right in the face but also the larger ecological crisis. If not the best, human perhaps is the only keeper of the future of a sustainable world.*

Keywords*: 1.Buddhist Economics 2. Posthumanism 3.Global South 4. E.F. Schumacher*

Environmental Footprint of Fisheries

Vindhya Patchava*

GITAM University, Visakhapatnam, India

**Corresponding Author: vpatchav@student.gitam.edu*

ABSTRACT: *The ocean ecosystem is an extremely complex place that should be protected for battling climate change, as it is the largest carbon dioxide reservoir around us. However, the ecological footprint left by fisheries is concerning. Each year as the human population increases, fish consumption and bycatch kills increase which can be easily overlooked. The overconsumption of fish and bycatch kills directly impact the different trophic levels of marine ecosystems, making irreversible mistakes. Furthermore, the everyday fishing activities around the planet are leaving behind a devastatingly huge amount of fishing gear in the oceans which is the main factor for marine pollution. This paper aims to provide a discourse analysis using X (#bycatch and #marinepollution). These tweets help us find out whether people around the world know about bycatch kills and that fishing gear is the major culprit behind marine pollution. With the help of secondary data, we will try to understand why nothing major is done to stop these activities and why not many people know about the impact they are having on the ocean ecosystem and, in turn, their own lives. Finally, concludes how plastic straws, plastic bottles and single-use plastics are dominating the conversion around marine pollution instead of fishing gear in X. With this information in mind, necessary recommendations like policy changes and pleas to increase awareness are highlighted.*

Keywords*: Ecological Footprint, Overconsumption, Bycatch kills, Fishing gear, Marine pollution*

Conceptualisation of Advanced Direct Air Capture – A Perspective to Sustain Decarbonisation

Mrinal Bhowmik*, Dibyendu Roy, Kumar Vijayalakshmi Shivaprasad, Anthony Paul Roskilly

Durham University, Durham, DH1 3LE, UK

**Corresponding Author: mrinal.bhowmik@durham.ac.uk*

ABSTRACT: *The current paper explores the conceptual framework and future potential of advanced direct air capture (DAC) systems, focusing on their role in achieving sustainable decarbonisation goals. It provides insights into next-generation DAC designs that can enhance the efficiency of carbon dioxide removal from the atmosphere. The research is based on a theoretical modelling approach that develops a DAC system in Aspen Plus without increasing the overall size, where the key components are the pellet and calcium oxide reactors. The study identifies several critical factors influencing the performance and cost-effectiveness of DAC systems. Key findings suggest that an advanced DAC system can capture 75-80% of CO2 from direct air, depending on the operating conditions, at an electricity requirement of 340 kWh/tCO2. Furthermore, the CO_2 capture efficiency is explained in detail for the developed model. The implications of this research extend to policymakers, engineers, and environmental scientists, offering a blueprint for more efficient and sustainable DAC systems. The adoption of the proposed systems could accelerate progress toward global carbon neutrality and mitigate the impact of climate change. This paper provides a unique perspective on advanced DAC systems, introducing novel technological modifications. The findings contribute to the growing body of knowledge on carbon capture, offering practical solutions for enhancing DAC effectiveness and supporting long-term decarbonisation strategies.*

Keywords*: Direct Air Capture (DAC); Carbon Dioxide Removal; Decarbonisation Strategies; Advanced Sorption Technologies; CO2 Capture Efficiency*

How do environmental impacts of fertilisers from fish processing and aquaculture production waste compare to mineral fertilizers?

Jan Landert[1,*], Nicolas Wittmann[1], Jean-François Fabre[2], Claire Vialle[2], Caroline Sablayrolles[2], Diogo A. Teixeira[3], Helena I. Monteiro[3], Carlos Bald[4], Bruno Iñarra Chastagnol[4], Laura de Baan[1]

[1]Research Institute of Organic Agriculture FiBL, Ackerstrasse 113, Box 219, 5070 Frick, Switzerland
[2]Laboratoire de Chimie Agro-Industrielle, LCA, Université de Toulouse, INRAE, Toulouse, France
[3]ISQ, Av. Prof. Dr. Cavaco Silva, nº 33, 2740-120 Porto Salvo, Portugal
[4]AZTI, Food Research, Basque Research and Technology Alliance (BRTA), Parque Tecnológico de Bizkaia, Astondo Bidea, Edificio 609, 48160 Derio- Bizkaia, Spain

**Corresponding Author: jan.landert@fibl.org*

ABSTRACT: *Mineral fertilizer production is based on the energy-intense Haber-Bosch process and on finite sources of phosphorous. In a circular economy, the potential of the production of fertilizer from organic waste streams should therefore be explored (Chojnacka, Moustakas, and Witek-Krowiak 2020; Zhang, Akyol, and Meers 2023). In our study, we assessed the environmental impacts of five Biobased fertilizers (BBF) produced in pilot facilities from different waste streams of the fish industry. In a first step, impacts of BBF production were analysed, including potential efficiency gains for a future industrial production. In a second step, environmental impacts of crop production were assessed for four BBFs with a high agronomic performance in two pot (ryegrass and wheat) and two field trials (both with broccoli). The environmental hotspots of BBF production as well as BBF application regarding Global warming, Mineral resource use, Terrestrial acidification as well as Freshwater and Marine eutrophication were identified.Environmental hotspots included the transport of sidestreams (both fresh and dried) to the BBF factory, the concentration process (removing water with different procedures), the packaging, as well as field emissions during application. Field emissions dominated the eutrophication impact categories while the production of BBF had a strong impact on Global warming and Mineral resources use. The comparison with mineral fertilizers resulted in similar, lower and higher impacts for BBF in comparison with mineral fertilizers, depending on the agronomic conditions and environmental impact category. This underlines the need to consequently optimize the BBF production and agronomic performance to reduce environmental impacts.*

Climate-Smart WASH Financing

Bonani Roychowdhury*

Nabsamruddhi, Maharashtra, India

**Corresponding Author: md.nabsamruddhi@nabard.org*

ABSTRACT: *As climate change intensifies, its impacts on water, sanitation, and hygiene (WASH) systems pose significant challenges to global health and development. Climate-Smart WASH Financing emerges as a critical approach to bridge the financing gap while building resilient, adaptive, and sustainable WASH systems. This abstract explores innovative financial mechanisms tailored to integrate climate considerations into WASH investments, ensuring long-term sustainability and equity. The paper examines the intersection of climate finance and WASH financing, showcasing successful models that blend public funds, private investments, and climate-related funding streams such as the Green Climate Fund (GCF). Case studies illustrate how climate-smart financing supports adaptive infrastructure, strengthens water resource management, and promotes circular sanitation economies. Special attention is given to nature-based solutions, community-driven financial models, and insurance mechanisms that mitigate climate risks while enhancing service delivery in vulnerable regions. The paper also highlights how digital tools and data-driven approaches can improve financial accountability and decision-making in climate-smart WASH initiatives. By emphasizing equity, resilience, and innovation, this paper outlines strategies to mobilize resources, foster multi-sectoral collaboration, and scale up climate-smart WASH financing. It concludes with actionable recommendations for policymakers, practitioners, and investors to align WASH financing with climate adaptation and mitigation goals, ensuring a sustainable future for all.*

Environmental Impact of Waste DISPOSAL

Mirza Anas Baig *
Lords Institute of Engineering and Technology, Telangana, India
**Corresponding Author: anasmirzabaig0@gmail.com*

ABSTRACT: *Waste disposal has become one of the most critical issues due to the high volume of wastes generated globally, mainly as a result of fast urbanization, industrialization, and consumerist tendencies. Low reuse of landfills, dumping in unauthorized areas, and ineffective recycling processes add to environmental degradation. This research paper aims to critically attempt to evaluate several adverse environmental impacts resulted in due to inappropriate waste disposal while enunciating the adverse effects on the quality of soil, water, and the atmosphere. This way, the improper disposal of waste causes the leakage of harmful chemicals such as heavy metals and toxic substances to the ground and soils affecting both human and ecosystem health. Methane production is a by-product of organic waste decomposition in landfills that is seen as a strong greenhouse gas entailing acceleration in climate change. In addition, natural environments are destroyed and biodiversity lost due to piling up of waste. The paper continues discussing recent developments in waste management: recycling, composting, and waste-to-energy technology, and landfilling pose the question whether the proposed solutions address environmental degradation. Techniques have evolved, but are normally too skimpy in the face of wastes multiplying exponentially. The results demand a system change through the adoption of a circular economy approach focusing on waste minimization, maximal exploitation of resources, and reuse of materials. In addition, it will be a crucial part of the overall research projecting the need, on account of extensive literature review, case studies, and environment impact analyses, for more elaborate and innovative waste management practices that would not only reduce the environmental footprint of waste but also be supportive of long-term ecological and economic sustainability.*

Keywords*:*

VII.
EV & ELV Recycling and E-Waste Management

Ternary Deep Eutectic Solvents for Leaching Active Cathode Material from Spent Mobile Lithium-Ion Batteries

K Appurva[1], P Hemanth[2], V M Aravind[2], Raju Kumar Gupta[2,3,4,5,*], Sudhir H Ranganath[1,6,*]

[1]Bio-INvENT Lab, Department of Chemical Engineering, Siddaganga Institute of Technology, Tumakuru, Karnataka, India
[2]Department of Chemical Engineering, Indian Institute of Technology Kanpur, U.P, India
[3]Department of Sustainable Energy Engineering, Indian Institute of Technology Kanpur, U.P, India
[4]Centre for Environmental Science and Engineering, Indian Institute of Technology Kanpur, U.P, India
[5]Chandrakanta Kesavan Centre for Energy Policy and Climate Solutions, Indian Institute of Technology Kanpur, U.P, India
[6]Tvastra InnoTech Solutions Pvt. Ltd., C/o Bio-INvENT Lab, Department of Chemical Engineering, Siddaganga Institute of Technology, Tumakuru, Karnataka, India

**Corresponding Author: guptark@iitk.ac.in, sudhirh@sit.ac.in*

ABSTRACT: *Spent Lithium Ion Batteries (LIBs) contain valuable metals (Li, Co, Mn, Fe), but their disposal poses environmental threats. Current recycling methods use toxic substances and hence sustainable greener alternatives are required. Deep Eutectic Solvents (DES) are environmentally friendly solvents with their unique blend of Hydrogen Bond Donor (HBD) and Hydrogen Bond Acceptor (HBA) in a specific ratio offering properties like lower freezing points, higher thermal stability, reduced volatility, tunability, and greenness. In this study, we report a lab-scale process using a novel ternary DES to dissolve waste battery cathodes. Spent / waste batteries from mobiles were dismantled and separated to extract active cathode material (ACM). Calcined ACM was analyzed using EDX and ICP-MS. Results revealed the absence of aluminum and presence of Li, Co, Mn, and Ni in the ACM. Our work demonstrates rapid leaching of recycled cathode material in 30 min at a significantly low temperature (vs. pyrometallurgical processes of above 700 °C) using the ternary DES mixture, resulting in > 99% Co and Li leaching efficiency. Further, stage-wise separation and conversion of cathode material into metal oxides was achieved through precipitation post-leaching.*

Keywords*: LIBs, Deep eutectic solvents, Active cathode material, Lixiviant, Leaching*

Addressing the Global Electronic Waste Crisis

R. Parameswari[1,*], D. Raj Balaji[2]

[1]Rathinam College of Arts and Science, Rathinam TechZone Campus, Eachanari, Tamil Nadu, India
[2]Department of Computer Science, Rathinam College of Arts and Science, Rathinam TechZone Campus, Eachanari, Coimbatore, India

**Corresponding Author: eswaripammi@yahoo.com*

ABSTRACT: *Green Businesses are the key drivers of the economy in the current global business scenario. Of the various green initiatives, waste recycling creates the highest positive impact on the environment. Of all the different types of waste, electronic waste has the characteristics of: (a) The fastest growing segment of waste (b) Most valuable due to its basic composition (c) Very Hazardous if not handled carefully. However, the sector is very new with only a few corporate players in India & globally. Electronic equipment waste (e-waste) processing has a large environmental footprint & climate effect that has not yet been well quantified. There are normally two ways to deal with non-recycled e-waste. In the U.S it often ends up in the landfill. In Asia, incinerators are commonly used to process e-waste. Neither solution is ideal. E-waste buried in the landfill contributes to greenhouse gases (GHGs) especially Methane. Moreover, E-waste incineration could be extremely damaging to the environment because of toxins & GHGs fume emissions. Since the recycling rates for e-waste has been low & the volume of electronics has been increasing, facilitating an efficient way to recycle is critical in shaping a sustainable future & helping with the climate change conundrum. The increasing efficiency of e-waste can contribute to a significant proportion of the tracked & non-tracked emission reduction.*

Keywords*: Hazardous Materials, Electronic Waste Reduction, Green Technology, Waste-to Energy, Consumer Education.*

Predictors of E-Waste Recycling Intention: Environmental Awareness, Knowledge, and Personal Norms

Narendra Rathnaraj*, Priyanga
PSG College of Technology, Coimbatore, Tamil Nadu, India
**Corresponding Author: naren@psgim.ac.in*

ABSTRACT: *An analysis of the determinants of recycling intention can result in improved and more efficient recycling initiatives within a community. The primary objective of this study was to investigate the factors associated with households' intention to recycle electronic garbage (e-waste). The study participants were selected from families located within the residential sections of the city of Coimbatore. Out of the 400 houses that were invited, 242 agreed to take part in the survey. A self-administered questionnaire was utilized to evaluate the socio-demographic characteristics and the notions of environmental knowledge, environmental awareness, and personal norms. The results indicate that the constructs have a significant impact on households' Recycling Intention. The study reveals that environmental knowledge is the strongest predictor of the intention to recycle. However, the inclusion of Environmental Awareness in the model resulted in a 0.192% increase in the variance of Recycling intention. In summary, our research indicates that possessing knowledge and awareness about the environment has a positive impact on households' intention to recycle electronic garbage.*

Keywords*: E - waste, Environmental Awareness, Environmental Knowledge, Personal Norms, Recycling Intention.*

E-Waste Management and its Challenges in Achieving Sustainable Development Goals in Indian Context

Mohd Talha Ahmad[1,*], Amol Murgai[2]
[1]Poona Institute of Management Sciences & Entrepreneurship
[2]Christ University (Lavasa)
**Corresponding Author: talha.pimse@gmail.com*

ABSTRACT: *Electronic waste (e-waste) management presents a critical challenge in the context of sustainable development (SD), particularly in India. This abstract explores the multifaceted dimensions of e-waste management within the Indian landscape, addressing the environmental, social, and economic ramifications. India, as one of the largest consumers of electronic products, faces escalating issues regarding e-waste generation, disposal, and recycling. The inadequate infrastructure and informal recycling sector exacerbate environmental degradation and pose health risks to communities involved in informal e-waste handling. Efforts to achieve sustainable development goals (SDGs) amidst these challenges require comprehensive strategies encompassing policy interventions, technological innovations, and societal engagement. Key stakeholders, including government bodies, industry players, non-governmental organizations (NGOs), and consumers, must collaborate to establish robust regulatory frameworks, promote eco-friendly design, and implement effective e-waste collection and recycling systems.*

Keywords*: E-waste management, Sustainable development, India, Environmental sustainability, Policy interventions, Technological innovation, Recycling, Informal sector, Health risks, Regulatory frameworks.*

Empowering Future Generations: The Educational Importance of Safe E-Waste Disposal and Recycling

Piyush Jethalya*
Swiss School of Business and Management, Switzerland
**Corresponding Author: jethalya@gmail.com*

ABSTRACT: *This paper explores the significance of educating children about the safe disposal and recycling of electronic waste (e-waste), emphasizing the economic, social, and environmental, health, and sustainability benefits. The study aims to highlight how early awareness can shape responsible consumer behaviours and contribute to a circular economy. A qualitative research approach was used, reviewing existing literature on e-waste management, environmental education, and sustainability. The paper analyses data from global reports and case studies to demonstrate the positive outcomes of youth engagement in e-waste disposal practices. The educational framework focuses on incorporating sustainability principles into early childhood curricula. The findings suggest that early education on e-waste significantly improves community practices in recycling and waste management. Economic benefits include resource recovery and job creation, while social benefits extend to reducing environmental justice issues in vulnerable communities. Environmental and health benefits arise from reducing toxic waste, protecting ecosystems, and minimizing health risks associated with improper e-waste disposal. This study offers practical insights for policymakers, educators, and environmental organizations to integrate e-waste education into school programs, ultimately fostering a culture of sustainability and responsible consumption. The study uniquely emphasizes the role of children in shaping future e-waste management practices, contributing to long-term environmental, social, and economic well-being.*

Keywords*: E-waste, Education, Recycling, Sustainability, Environmental health*

Revisiting the Challenges of E-waste Disposal and Recycling Techniques Case of India

Kavita Mathad[1,*], Amitava Pal[2]
[1]Presidency University Bangalore, India
[2]ICFAI University, Jharkhand, India
**Corresponding Author: drkavitamathad@gmail.com*

ABSTRACT: *Electronic waste is one of the environmental challenges posed by the ever-advancing technology in the world of electronic products. With the increasing pace of globalization and the tremendous pressure of businesses, new electronic gadgets, and appliances have infiltrated every aspect of our daily lives. Rapid technological innovations and a higher obsolete rate, compounded by dumping from developed countries are leading to a substantial rise in e-waste along with rapid depletion of natural resources. The recycling and disposal of e-waste when done correctly is expensive because of the technicalities involved, because of which a huge volume of e-waste is being exported to developing countries like India, China, and Brazil, just to mention a few. Indian e-waste recycling market majorly witnesses unscientific and unhygienic processes of extracting metals like gold, silver, and copper, from e-waste that result negatively on the workers and environment. Nevertheless, this makes the e-waste recycling markets more lucrative especially when the recycling is done in an unorganized sector in a very rudimentary way rather than a scientific way. This market is focused more on profits rather than social or environmental concerns. Recognizing the intensity of the problem, this study mainly focuses on understanding and reviewing the problem of e-waste management from two dimensions, one, is on handling the volume of the e-waste that is generated, and the other aspect is the working model framework that can boost the value chain proposition to ensure a robust procurement channel.*

Keywords*: E-waste recycling, Health Hazard, Extended Producer Responsibility, Producer Organization Responsibility, Environmental Policy.*

E-Waste – The Environmental Impacts and Solutions

K.L. Vincent Joseph*, P.G. Priyadarshini, N.T. Mary Rosana, Bavithra. B

Department of Chemical Engineering, Rajalakshmi Engineering College (Autonomous), Chennai, India

**Corresponding Author: vincentjoseph.kl@rajalakshmi.edu.in*

ABSTRACT: *Electronic trash, also referred to as E-waste is the waste generated by electronic equipment without the intent of reuse is one of the most challenging problems in the industrial world. Electronic devices have a definable lifespan, which necessitates their replacement on a periodic basis, resulting in E-waste. Recovery technology of precious metals such as lanthanum, silver, gold, palladium, platinum are done by mechanical and physical techniques, pyrometallurgy, hydrometallurgy and bio metallurgy. Inferior recycling of e-waste is a threat to public health and safety. The international health community unit, researchers, politicians as well as non-governmental organisations and national governments must work together to create awareness on E-waste exposure and its health consequences. Techniques such as physical disassembling, component recycling, metal extraction, and the reclaiming of non-metallic materials having long term impact on the environment are described. In order to create a sustainable future, research has to be done on the creation and disposal of e-waste as well as the development of environment friendly technology for recycling and collecting it. Administering e-waste in the future is probably going to be more allied and efficient and in harmony with the environmental sustainability along with technical growth. Worldwide cooperation will be crucial to address e-waste challenges, sharing best practices and innovations to manage waste effectively. This work describes various sources of E-waste, environmental hazards, its composition and characterization, metal recovery techniques and current research development.*

Keywords*: E-waste, metal recovery, hazardous, E-waste management.*

Electric Vehicles at a Crossroads: Sustainability through the Lenses of Information, Adaptability, and Income

Pooja Kanojia[1,*], Ayushi Tiwari[2], Preeti Sharma[3]

[1]Dept. of Commerce, Graphic Era Deemed to be University, Dehradun, India

[2]Dept. of Management, Scope Global Skills University, Bhopal, Madhya Pradesh, India

[3]Dept. of Bachelor of Management Studies, GD College of Arts, Commerce and Mumbai, Maharashtra, India

**Corresponding Author: poojakanojia786@gmail.com*

ABSTRACT: *Electric vehicles (EVs) are recognized as essential for mitigating the impacts of air pollution and climate change, especially in countries severely affected like India, which holds the third-worst global ranking for air quality. This study investigates the potential of EVs to enhance sustainability in the transportation sector, focusing on how information availability, technology adaptability, and income levels influence EV adoption and sustainability. Using Structural Equation Modeling (SEM) to analyze responses from a stratified random sample of 600 participants, the research highlights that effective information dissemination significantly improves sustainability outcomes, demonstrated by a substantial positive beta value of 0.590 ($p < 0.001$). Adaptability also positively impacts sustainability, with a beta value of 0.297 ($p < 0.001$), suggesting that flexible infrastructure and policies enhance EV integration. In contrast, income did not show a significant effect, with a beta value of -0.032 ($p = 0.066$), indicating that higher income alone does not guarantee increased sustainability through EV adoption. These findings suggest that while economic factors are crucial, raising public awareness and upgrading technological support are equally important. The study contributes to the global discourse on reducing greenhouse gas emissions. It emphasizes socio-economic factors' nuanced role in shaping sustainable development, particularly in regions with critical pollution levels.*

Keywords*: Electric Vehicles (EVs), Sustainability, Air Pollution, Structural Equation Modeling (SEM), Technology Adoption.*

Green supply Chain Management of E-Waste To Resource

Mariadas Sanjay Agrapu*
Department of Law Berhampur University, India
**Corresponding Author: agrapu@gmail.com*

ABSTRACT: *At present E-waste is generated at a rapid rate in the world. This is mainly due to the advancements in technology and developments in socio economic sectors. There are many hazardous chemical compounds generated from different types of e-waste that affect human health and ecosystems. Global urbanisation, escalating energy costs and population growth adversely influenced the environment. Both developing and developed countries have generated large quantities of e-waste in the form of electrical, electronic equipment, electronic batteries, computer components, and electronic gadgets. This identifies an imminent challenge to apply green supply chain management to e-waste. Proper attention should be paid for handling, storage, transportation, recycling and final disposal. There should be proper monitoring between e-product production and the amount of e-waste generated. It is important to achieve sustainability that improves yields and income without compromising environmental integrity. The need of the hour is to change the consumption patterns of using e-waste efficiently and convert them into valuable products. This paper identifies e-waste in particular with reference to electronic batteries, their comprehensive global e-waste management policies that could help to achieve a sustainable and environmentally sound processing of electronic batteries. These technologies should maximise energy efficiency, save and preserve the environment.*

Keywords*: E-Waste, Transboundary E-Waste movement, Extended Producer Responsibility, Green Supply Chain Management.*

Enhancing Reverse Logistics through a Blockchain and Neural Network Approach to Electronic Gadget Life Cycle Tracking

Ramakurthi Veerababu[1], Ankit Kumar[2], Sai Sudhakar Nudurupati[3,*]
[1]Department of Operations and Supply Chain, GITAM School of Business, GITAM University, Hyderabad, Telangana, India
[2]Department of Electronics and Communication, IIITDM Kurnool, Andhra Pradesh, India
[3]Department of Operations and Supply Chain, GITAM School of Business, GITAM University, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: sudhakar.nudurupati@gitam.edu*

ABSTRACT: *The significance of handling Reverse Logistics (RL) within the electronic goods sector has increased due to the emphasis on eco-friendly product disposal and the retrieval of components, driven by environmental concerns and regulatory demands. The refurbished and used mobile phone market size is valued at US$ 53.81 billion in 2022 and is expected to grow at a CAGR of 10.8% during the forecast period, reaching US$ 120.96 billion by 2030. With a lot of emphasis given on the RL aspects. This paper proposes a framework that uses blockchain based Hyper-Ledger that records the life cycle history of the electronic gadget on an immutable ledger. Additionally, a neural network helps to calculate the quality index of the gadget and also the price. Quality Index (QI) considers various sensory data into account and estimates the status of the gadget with certain accuracy. Smart contract provides automated transaction options between targeted stakeholders that helps to mitigate the security issues that happened among the stakeholders of the RL process. The integrated frameworks act as a decision maker for evaluating the condition of the mobile product or further movement into the RL process. In all, the traceability of product life cycle history assists in ensuring the quality of the returned products therefore optimizing the traditional quality inspection processes involved in reverse logistics of the electronic goods sector. The integration of blockchain and neural networks creates a robust and private ecosystem for stakeholders involved in reverse logistics. The stakeholders of the entire mobile electronic gadget experience a transparent system that helps to achieve sustainable reverse logistics principles.*

Keywords*: Reverse Logistics, Block chain, Neural Networks, Smart Contracts, Electronic Gadget.*

Techno economic feasibility of co-gasifying e-waste and sewage sludge: an equilibrium modelling approach

Haider Khan, Isam Janajreh*

Department of Mechanical Engineering, Khalifa University of Science and Technology, Abu Dhabi, United Arab Emirates

**Corresponding Author: Isam.Janajreh@ku.ac.ae*

ABSTRACT: *The escalating accumulation of electronic waste (e-waste), particularly printed circuit boards (PCBs), presents severe environmental and economic challenges. In this proposed study, we aim to assess the technoeconomic feasibility of co-gasifying e-waste with sewage sludge as an innovative waste-to-energy solution. Using equilibrium modelling and comprehensive material characterization data, we will evaluate various mixture ratios of PCBs and sewage sludge to identify optimal conditions for syngas yield, energy recovery, and Cold Gas Efficiency (CGE). This model will provide a preliminary analysis of performance across different gasifier configurations and operating parameters, laying the groundwork for a more detailed economic evaluation. Our proposed approach will investigate key factors influencing process economics, such as feedstock costs, energy outputs, and equipment scalability. By examining a range of mixture ratios, this study aims to identify the blend that maximizes energy production while minimizing costs, offering insights into the financial viability of e-waste as a co-gasification feedstock. A sensitivity analysis will be conducted to pinpoint the critical parameters affecting economic outcomes, such as gasifier temperature, feedstock proportions, and residence times. The findings from this proposed techno economic analysis will provide actionable insights for scaling co-gasification technologies, potentially transforming e-waste management into a viable energy production avenue. We aim to present this study as a preliminary framework to guide future high-fidelity modelling and experimental efforts, contributing to sustainable waste management practices and circular economy initiatives.*

Keywords*: E-waste; Sewage_Sludge; Gasification; Technoeconomical; Printed_Circut_Board.*

Transforming E-Waste into Art: Sustainable Crafting for Environmental Awareness

Sreeja C*, S.N Kumar, Arun S, Jomin Joy, Deljo Shaju, Rohit Rajan Eapen

Amal Jyothi College of Engineering, Kanjirapally, Kottayam, Kerala, India

**Corresponding Author: csreeja@amaljyothi.ac.in*

ABSTRACT: *One of the major environmental concerns is rising e-waste. An overwhelming volume of outdated electronic devices is discarded every year worldwide. Recycling the e-waste into crafts not only combats the problem but also creates new lines of sustainable creativity and environmental awareness. It discusses new ways in which e-waste constituents, such as circuit boards, wiring, chips, and casings, can be creatively used to make functional or ornamental pieces of art. Through a process of thorough selection, disassembly, and creative design, such electronic elements that are discarded from electronic appliances are used in the form of unique sculptures, jewellery, wall art, or other aesthetic pieces. Apart from emphasizing the inherent beauty of electronic materials, this activity also promotes the circular approach to waste management, whereby artists, designers, and environmentalists can give meaningful life to non-biodegradable waste. This visual installation project expresses the effects of technology, promotes sustainable art-making and design and hence can have an impact on the environmental as well as educational aspects since it creates awareness about e-waste and at the same time inspires creative recycling solution. The ewaste components that are generating in our labs day to day activities in an organization can be effectively used for the making of crafts, there by an efficient method for the e waste management.*

Keywords*:*

E-Waste Management

Khaja Fareed Uddin*, Vikas Paul, Md Jalaluddin
India
**Corresponding Author: md.jalal113@gmail.com*

ABSTRACT: *E-waste management has become a critical global issue due to the rapid growth of electronic waste resulting from technological advancements and increased consumerism. This paper explores the challenges and solutions associated with the effective management of e-waste, which includes discarded electronic devices such as computers, smartphones, and televisions. The improper disposal of e-waste poses significant environmental risks due to the release of toxic substances, while also representing a missed opportunity for resource recovery. Effective e-waste management strategies encompass various approaches, including recycling, refurbishing, and responsible disposal. Implementing comprehensive legislation, promoting awareness, and fostering public-private partnerships are essential to enhance e-waste collection and recycling efforts. Moreover, innovative technologies and processes can significantly improve the recovery of valuable materials, such as metals and plastics, thereby reducing the need for virgin resources-waste management in Hyderabad has been evolving, with various initiatives aimed at addressing the growing challenge of electronic waste. Here are some key points about e-waste management in the city: Awareness Campaigns: Local NGOs and government bodies often conduct awareness programs to educate residents about the importance of proper e-waste disposal and recycling. Collection Centres: Several collection centres and e-waste recycling facilities have been established to facilitate the safe disposal of electronic waste. Residents can drop off their old electronics at these locations. Corporate Initiatives: Some companies in Hyderabad have adopted sustainable practices, offering take-back programs for their products and collaborating with certified e-waste recyclers. Government Regulations: The government has implemented regulations to ensure responsible e-waste management. This includes guidelines for the disposal and recycling of electronics. Recycling Facilities: The city has seen the emergence of specialized e-waste recycling facilities that process and recover valuable materials from discarded electronics, minimizing environmental impact. Public-Private Partnerships: Collaboration between the government and private sector has been encouraged to improve infrastructure and enhance e-waste management practices. Research and Innovation: Some academic institutions and start-ups in Hyderabad are exploring innovative technologies for efficient e-waste recycling and resource recovery. Efforts are ongoing to improve the overall e-waste management system, making it more effective and sustainable for the future. The study emphasizes the importance of a circular economy model, where e-waste is seen as a resource rather than waste. By integrating sustainable practices into the lifecycle of electronic products, stakeholders can mitigate environmental impacts and promote resource efficiency. This abstract serves as a foundation for understanding the complexities of e-waste management and the necessary steps to create a more sustainable future.*

Keywords*: E-waste, Recycling,Sustainability,Waste Reduction, Circular Economy, Resource Recovery, Hazardous Materials, Electronic Disposal, Repair and Refurbishment, Environmental Impact, Regulations and Compliance, Collection Program*

Maximizing Non-Metal Purity in PCB Recycling Through Gas-Solid Fluidized Bed Techniques

Parthasarathi R. R. Sam David Swaminathan*
Department of Chemical Engineering, SRM Institute of Science and Technology, Chennai
**Corresponding Author: ssamdavid22@gmail.com*

ABSTRACT: *The amount of non-metals in PCB fractions decreases the cost effectiveness and the efficiency of hydrometallurgical and pyrometallurgical metal extraction processes. In this work, a gas-solid fluidized bed is used to segregate non-metallic fractions from crushed PCB particles based on density. The effects of PCB particle size, gas velocity, column height, and diameter are optimized for better separation of non-metallic fractions. The purity of the product is verified through density measurements of the bottom product and XRF analysis. A maximum purity of metallic fractions with 90–95% is achieved with various particle size fractions. This method demonstrates an effective approach for enhancing the segregation and purity of metallic components in PCB recycling, contributing to more efficient downstream metal extraction processes.*

Keywords*: PCBs Recycling; Non-metallic fractions; Gas- solid fluidized beds; Density segregation; XRF Characterization.*

End-of-Life Vehicle and E-waste Recycling in Japan

Yoshinori Morita*
Dowa Eco-System Co., Ltd.
**Corresponding Author: moritay1@dowa.co.jp*

ABSTRACT: *Japan's recycling system aims to protect the environment and make efficient use of resources, with specific recycling systems established for different types of materials. For example, the Home Appliance Recycling Law targets household appliances such as televisions, refrigerators, washing machines, and air conditioners, while the End-of-Life Vehicle Recycling Law targets used automobiles. Businesses play a crucial role in the recycling system. Specifically, they are responsible for the collection and transportation of recyclable waste, the development of new recycling technologies, and the reuse of recovered resources. This promotes the circular use of resources and contributes to the realization of a sustainable society. DOWA Holdings, a key player in this field, operates in various sectors including environmental and recycling services. We utilize advanced technologies to recycle metals and other materials, contributing significantly to resource circulation and environmental protection. In this presentation, we will introduce the legal systems for home appliance recycling and vehicle recycling, and share our technological processes. In this way, Japan's recycling system aims to achieve a sustainable society through the cooperation of businesses and citizens in protecting the environment and making efficient use of resources.*

Keywords*: Circular use of resources, Business, Environmental protection, Efficient use of resources*

E-Waste Management

Khaja Fareed Uddin, Vikas Paul, Md Jalaluddin*
Lords Institute of Engineering & Technolgy, London, UK
**Corresponding Author: md.jalal113@gmail.com*

ABSTRACT: *E-waste management has become a critical global issue due to the rapid growth of electronic waste resulting from technological advancements and increased consumerism. This paper explores the challenges and solutions associated with the effective management of e-waste, which includes discarded electronic devices such as computers, smartphones, and televisions. The improper disposal of e-waste poses significant environmental risks due to the release of toxic substances, while also representing a missed opportunity for resource recovery. Effective e-waste management strategies encompass various approaches, including recycling, refurbishing, and responsible disposal. Implementing comprehensive legislation, promoting awareness, and fostering public-private partnerships are essential to enhance e-waste collection and recycling efforts. Moreover, innovative technologies and processes can significantly improve the recovery of valuable materials, such as metals and plastics, thereby reducing the need for virgin resources. E-waste management in Hyderabad has been evolving, with various initiatives aimed at addressing the growing challenge of electronic waste. Here are some key points about e-waste management in the city: Awareness Campaigns, Collection Centers, Corporate Initiatives, Government Regulations, Recycling Facilities, Public-Private Partnerships, Research and Innovation. Efforts are ongoing to improve the overall e-waste management system, making it more effective and sustainable for the future. The study emphasizes the importance of a circular economy model, for e-waste as a resource. By integrating sustainable practices into the lifecycle of electronic products, stakeholders can mitigate environmental impacts and promote resource efficiency.*

Keywords*: Recycling, Sustainability, Circular Economy, Hazardous Materials.*

VIII.
Food & Vegetable Waste Management

Utilization of Beet Greens a Food Waste to Develop a Sandwich Spread: A Solution to Tackle Iron Deficiency Anaemia and Other Micronutrient Deficiencies in India

Fatima Aziz Kader*, Saniya Charles Tuscano
College of Home Science Nirmala Niketan, Affiliated to university of Mumbai, India
Corresponding Author: fatimakader@nnchsc.edu.in

ABSTRACT: *Food wastage is a significant concern in a country like India with a high prevalence of under nutrition. As of 2019, the Food and Agriculture Organization (FAO) reported that approximately one-third of all food produced for human consumption is lost or wasted globally. Beet greens are the leafy green portion of the beetroot plant. Beetroot is a common vegetable consumed in India, however the beet greens are discarded as waste. The wastage of beet greens is particularly concerning given their rich nutritional content of vitamin and mineral including vitamin K, vitamin A, folate, potassium, iron and calcium and in addition dietary fiber which could help address dietary deficiencies in India. Anemia, is a widespread health problem in India. The NFHS-5 data shows a prevalence of anemia as 57 % in women (15 to 49 years) and 67.1% in children (6 to 59 months). A sandwich spread is a ready to eat (RTE), convenient food product with a long shelf-life. Beet greens was combined with other ingredients (milk powder, vinegar, oil and flavoring ingredients) to prepare a sandwich spread with improved iron bioavailability. The product developed had 48.51g of fat, 6.22g of protein, 11.6 mg of iron, 355mg of calcium, and 7.28g of fibre (IFCT, 2017). The sensory evaluation of the product was conducted by 10 trained panelists using a seven point hedonic scale. The appearance, color, mouth feel, aroma, consistency flavor taste, all obtained scores as 6.4 , 6.5 , 6.2 , 6.5 , 6, 6.5 , 6.0 and 6.5 respectively.*

Keywords*: Beet greens, anemia, iron bioavailability and sandwich spread.*

Production of Organic-Fertilizers from Vegetable and Cereal Wastes

Sumit Biswas, Souptik Bhattacharya*, Saikat Mazumder*
Department of Food Technology, Guru Nanak Institute of Technology, Kolkata, West Bengal, India
**Corresponding Author: souptik.bhattacharya@gnit.ac.in, saikat.mazumder@gnit.ac.in*

ABSTRACT: *Food waste is a major concern in today's world where lots of inedible parts of foods (peels,*
skins) becomes a waste that can be utilized to produce organic fertilizers alternative to inorganic fertilizers that have an adverse effect on the ecosystem. This experiment is carried out with potato peels, pigeon pea skins, grass pea skins and moong dal skins and make a fine powder by tray drying(at 65°C for 2 hours) and mechanical grinding method and mixed them to make a organic fertilizer. The main objective when embarking on this undertaking aims to devise an approach to gather inedible, discarded part of some vegetables and cereals from different firms and translating them into effective organic fertilizer that can increase soil fertility, increase the abundance of harmless microbes, give better growth to plants without any toxic effects. Using the waste products as organic fertilizers for plants can be preserved the ecological balance in addition to enriching consumers with better health. For this research, some vegetable and cereal inedible wastes have been acquired from manufacturing facilities and have been dried to yield fine powder for fertilizer. These powdery fertilizers were thereafter put onto variety plants (Cabbage, Cauliflower, Chili, Green peas) and the average growth rate of their leaves was monitored. This study additionally evaluated the outcomes by contrasting the development of the plant leaves in two variations (with and without the fertilizer). It demonstrated an advantageous outcome when incorporating the derived organic-fertilizer and the average leaves growth increased by 1.9-4 cm.

Keywords*: Soil-fertility, Biodegradable, Food waste, Bio-fertilizers, Sustainability.*

Sustainable Management of Floral Waste: Challenges, Innovations and Solutions

P. Anil Chowdary*
Green Waves Environmental Solutions, Andhra Pradesh, India
**Corresponding Author: anil@greenwavesrecyclers.in*

ABSTRACT: *India has a rich cultural heritage spanning over 5,000 years, during which flowers have been integral to religious and traditional practices. This creates a substantial demand for flowers such as marigold, rose, and chrysanthemum. However, the extensive use of flowers generates significant floral waste. Out of the 72 million tonnes of solid waste produced annually in India, approximately 4% consists of floral waste. Conventionally, floral waste disposal follows two primary methods: it is either dumped into nearby water bodies, such as lakes or rivers, or sent to landfills. The first method, involving disposal into water bodies, introduces chemicals used in the cultivation of flowers, disrupting the ecological balance of aquatic ecosystems. In landfills, floral waste is often mixed with other types of solid waste, leading to challenges in segregation and recycling. These methods of disposal are environmentally detrimental, despite floral waste being fully recyclable and capable of generating valuable by-products. Various organizations and small-scale industries have been working towards recycling floral waste into value-added products like incense sticks and dhoop cones. At present, this recycling effort operates at a cottage industry scale, where the process involves the collection, segregation, natural drying, and manual crushing of flower petals. The crushed petals are then hand-rolled onto thin sticks after being mixed with organic binding agents to produce incense sticks. Despite its promising potential, the existing floral waste recycling process is limited by its inefficiency. The time required to transform floral waste into a finished product ranges from 7 to 11 days. Notably, the implementation of a solar dryer has significantly reduced the drying period from the traditional 2–5 days to just one day per batch. This innovation enabled an increase in the unit's capacity from 800 kg to 3,200 kg per week, demonstrating the potential for scaling up the recycling process to a more industrial level.*

Keywords*: Floral waste, Valorisation, Sustainability, Waste management, Circular Economy.*

Socio-Economic Influences on Food Waste Behaviours in Rapidly Urbanising Contexts: A Case Study of Long Bien, Hanoi

Analyn Regina, Emerson Richmond Burke*, Angel Riofrio
Department of Sustainable Development, KU Leuven, Leuven, Belgium
**Corresponding Author: Coemerson.richmondburke@student.kuleuven.be*

ABSTRACT: *Globally, there is a noticeable trend of increasing urban populations as people migrate from rural areas for various socio-economic and environmental reasons. This shift leads to rapid urbanization characterized by inadequate urban planning, the prevalence of urban agriculture, peri-urban development, socio-economic disparities, and food insecurity. Within this context, the social, spatial, and economic attributes of the food environment are crucial for understanding how individuals manage food, particularly in terms of food waste. Food waste presents significant environmental, social, and political challenges. Research has indicated that Vietnam faces high levels of food waste in both urban and rural settings, highlighting existing barriers to effective management of this issue. However, opportunities arise in rapidly urbanizing areas where food waste can be repurposed as animal feed or bio-fertilizers. This study aims to explore the socio-economic and environmental factors influencing food waste behaviours in Long Bien, Hanoi, a district marked by rapid urbanisation and notable socio-economic diversity. Through randomly sampled surveys of households and vendors, the research will examine aspects such as the volume of food waste, disposal methods, and sources of food procurement. This comprehensive analysis will shed light on how socio-economic factors and food sourcing impact food waste behaviours. Ultimately, the research seeks to inform targeted interventions to reduce food waste through community-driven initiatives and well-informed policy changes. The insights gained will provide valuable guidance for managing food waste in urbanizing contexts, benefiting not only Vietnam but also other developing countries facing similar challenges.*

Keywords*: Food waste, Vietnam, urbanization, urban agriculture, socio-economic characteristics, environmental factors.*

A Paradigm shift in Food Waste Management through Artificial Intelligence (AI): A review

Chaitali Bose*

Dept of Physiology, Hooghly Mohsin College University of Burdwan, West Bengal, India

**Corresponding Author: Chaitali.bose85@gmail.com*

ABSTRACT: *Sustainable Development Goals (2015) that focuses on 'zero hunger', 'food security', 'responsible approach towards consumption and production' and 'action on climate change' are strongly pertinent to food waste management (FWM). Approximately one third of global food production turns out as food waste that results loss of natural resources, emission of green house gases (GHS) and economic downfall globally. Though multi-faceted traditional approaches coupled with advance technology have been taken into account worldwide but mammoth disposal, food contaminations, inefficiency in funds and infrastructure to redistribution of excess food especially in developing countries, failure to execute precise collection and presence of hazardous and non bio-degradable composition in food packaging add more complexity in sorting or recycling of waste materials. However introduction of Artificial Intelligence (AI) in FWM has emerged a new domain of research to be explored extensively. AI based technology like machine learning or smart agriculture can optimize food production and utilization through predictive analytic logarithm like weather condition or consumers' preferences; internet of things, sensors or AI image recognition help to control and monitor food quality and prevent food contamination or spoilage; applying AI to programs like food rescue in society provide data regarding surplus food, its quality, accessibility and redistribution; smart waste management using smart bins, automated sorting and precise quality control or monitoring while recycling can be made possible. But the huge expense, data accuracy and privacy concerns are some major limitations to be dealt with future research and endeavours from all stakeholders of society to support sustainability and equitability in food industry, promote circular economy and to maximize resource utilization with minimal waste and environmental impact.*

Keywords*: Food waste management, Paradigm shift, Technology, Artificial intelligence, food supply chain.*

Development of Pineapple Fiber Extraction Machine

COLEMAN C. TIW-AN*, Emily M. Casenio, Karen Jane G. Monato, Mary Janelle V. Valdez

Department of Agricultural and Biosystems Engineering, College of Engineering and Technology, Western Philippines University, San Juan, Aborlan, Palawan

**Corresponding Author:*

ABSTRACT: *Pineapple leaves are one of the sources of natural fiber but these are being piled-up in the farm during production of pineapples. This study was conducted to turn these "waste" into useful fibers and to develop a pineapple fiber extraction machine. Specifically, it aimed to design and fabricate a pineapple fiber extraction machine, evaluate the performance of the machine in terms of capacity, fiber recovery, and extraction efficiency, and conduct a simple cost analysis on the use of the machine. The machine was fabricated based on the design plan which was comprised of the main frame, intake hopper, fluted roller, beater bar, extraction cylinder unit, and power transmission assembly. The performance of the machine was evaluated in terms of fiber extraction capacity, fiber recovery, and extraction efficiency with 3 treatments (600 rpm, 700 rpm, and 800 rpm). Results revealed that the machine has a capacity of 0.26 kg/hr in terms of dry-cleaned fiber, fiber recovery of 1.63%, and extraction efficiency of 93.14%. The machine has an investment cost of Php34,023.00. The cost analysis revealed to have a return on investment (ROI) of 32.7% and a payback period of 0.03 years.*

Keywords*:*

Valorising Food Waste into Protein-Rich Pet Feed using Black Soldier Fly Larvae

Ravikanti Venkata Sricharan[1,*], Mukesh[2], N Sai Sudhakar[3]
GITAM School of Business, India
**Corresponding Author: vravikan@gitam.in*

ABSTRACT: *Purpose: This study explores the potential of valorising food waste by converting it into high-value products using Black Soldier Fly Larvae (BSFL). The research highlights BSFL's ability to decompose organic waste, particularly food waste, into protein-rich biomass suitable for pet food, thereby contributing to waste management, environmental sustainability, and the circular economy.*
Design/methodology/approach: A systematic literature review is conducted to examine the current research on BSFL-based food waste management. The study also employs a case study approach to perform a SWOT analysis of BSFL-based food waste valorisation, assessing its economic viability and environmental impact.
Findings: BSFL efficiently converts food waste into valuable protein sources for pet food while producing nutrient-rich frass, a potential fertilizer. The process offers an innovative solution to waste management by diverting food waste from landfills, reducing greenhouse gas emissions, and supporting the circular economy.
Implications: The findings provide insights into the economic potential of using BSFL for food waste management, addressing challenges in sustainability and contributing to the growing demand for sustainable pet nutrition. This approach could play a key role in advancing waste valorisation practices globally.
Originality/value: This research contributes to the growing body of knowledge on sustainable food waste management through biological solutions. It demonstrates the feasibility of BSFL as an eco-friendly, cost-effective approach to addressing global food waste challenges and producing sustainable animal nutrition.

Keywords*: Black Soldier Fly Larvae, food waste valorisation, pet food, sustainability, circular economy*

Sustainable solutions: Valorizing Waste Cooking oil for a Circular Economy in Rural Microgrids

Kanimozhi T, Anbuselvam R U, Abhisekh S , Lalith Pankaj Raj G N*, Kirubakaran V
Centre for Rural Energy, Gandhigram Rural Institute – DTBU, India
**Corresponding Author: lpraj1995@gmail.com*

ABSTRACT: *India is fortunate to have a wide range of oil seed crops grown in its different agro-climatic zones. Annually about 23 million MT of cooking vegetable oil is consumed in India. Due to repeated frying, Total Polar Compounds (TPC) are formed in the cooking oil, so to safeguard consumer health, FSSAI has fixed a limit for TPC at 25% beyond which the cooking oil shall not be used. Research indicates that there is a potential to recover about 3 million MT of this oil, which can be used for valorization and can produce about 3 MW of energy. Used cooking oil is a hazardous waste since it can pollute land and marine ecosystems, clog drains, and add to the cost of water treatment if it is not disposed of properly. This paper proposes a novel approach toward the blending of conventional fuel and waste cooking oil as an alternate fuel source. The optimum ratio of blending for better efficiency is studied through experimentation with a 5 KVA Kirloskar Shakthi dual-fuel engine. Research indicates that centralized facilities may prove inadequate in handling the ever-increasing volume of plastic waste generated due to collection and transportation difficulties. Consequently, this study advocates for an innovative decentralized power generation strategy to augment isolated micro-grid systems in remote rural regions. This could reduce the diesel consumption of the grid, at the time of backup power generation by repurposing the used cooking oil. This approach will increase awareness of the environmental impacts and waste reuse in rural communities enhancing the circular economy.*

Keywords*: Valorization: Used cooking oil, Energy generation, Sustainability, Circular economy*

IX.
Industrial Waste Management

Characterization of Activated Charcoal mixed with Zirconium Hydroxyapetite by Using Hydrothermal Technique

K. Sumila Reddy[1,*], Randhi Uma devi[2,*]

[1]Dept. of Environmental Science, GITAM Deemed (To Be) University, Vishakhapatnam, India
[2]Dept of Chemistry, GITAM Deemed (To Be) University, Hyderabad, India

**Corresponding Author: skunduru@gitam.in, urandhi@gitam.edu*

ABSTRACT: *Activated carbon eliminates a wide range of organic, inorganic, and biological contaminants from soil, air, and liquids because of its sizeable inner surface area and excellent porosity. Due to its potent adsorption ability, particularly against heavy metals, activated carbon is a well-known adsorber that has recently attracted attention from the wastewater treatment industries. Films of Zirconium Hydroxyapatite were prepared by using Fish Meal Bones. AC-Zr HAP, a composite material based on zirconium hydroxyapatite and activated charcoal, shows great potential for environmental cleanup, water purification, and biomedical implants. With enhanced mechanical qualities, bioactivity, and adsorption capacities, this composite eliminates contaminants and breaks them down. Kinetic, thermodynamic, and isothermal models explain the adsorption process. A hydrothermal method was performed to synthesize Zr-HAP using activated charcoal. FTIR, SEM, EDS, TEM, and XRD are characterization techniques used to verify the existence of hydroxyapatite, zirconium incorporation, and interactions with activated charcoal. Many parameters, such as solution content, pH, temperature, time, and adsorbate type, affect how well dye or heavy metals are removed. A UV-Vis spectrophotometer creates calibration curves for dyes such as Methylene Blue and Rhodamine-B. The specific features of concern, such as structural integrity, chemical composition, and surface area performance, are considered when choosing the right characterization techniques to maximize the material's performance in environmental and biomedical applications.*

Keywords*: Adsorption, Heavy Metals, FTIR, SEM, TEM, Methylene blue.*

Synergistic Extraction of Lead (II) with TBuA and TPPO

V L N S H Hariharan*, Mumtaz Begum

Department Of Chemistry, GITAM Institute of Science, GITAM University, Visakhapatnam, India

**Corresponding Author: hagastya@gitam.edu*

ABSTRACT: *Amines are a very effective extractant for separating heavy and toxic metals, such as Pb(II), Cd, and Zn. Pb(II) was extracted following a synergistic extraction technique from an aqueous solution in an acidic medium using xylene as a diluent in triphenylphosphine oxide (TPPO) and tributylamine (TBuA). Temperature changes, pH levels, and time intervals aiding lead extraction were also investigated using stoichiometric analysis. The effects of different extractants, concentration of mineral acid, diluent and stripping agents, as well as other thermodynamic parameters like the Gibbs free energy (ΔG), enthalpy (ΔH), and entropy (ΔS) were also investigated. Spontaneous endothermic reaction occurred in the triphenylphosphine oxide and tributylamine mixture, with a maximum extraction of lead(II) (99.74%) in two steps. Furthermore, the Formation of the amine complex R3NH+ and Pb(SO4)-22 resulted in the enhanced extraction with more significant concentrations of sulfuric acid.*

Keywords*: Lead (II) ions, Triphenyl-phosphine oxide (TPPO), Tributyl-amine (TBuA), xylene, stripping agents, and mineral acid.*

Potential of Chayote as a Precursor for Activated Carbon prepared by Chemical Activation for the Removal of Heavy Metals

Nikili K Zhimo[1,*], Neilanuo Huozha[1], Daniel Kibami[1], Bendangsenla N[2]

[1]Department of Chemistry, Kohima Science College (Autonomous) Jotsoma, Nagaland, India
[2]Department of Chemistry, Patkai Christian College, Chümoukedima-Seithekema, Nagaland, India
**Corresponding Author: nikilikzhimo@gmail.com*

ABSTRACT: *Heavy metal disposal into the environment and even more so the aquatic environment has increased significantly in the last few decades due to rapid industrialization. With the constant development of methods to purify contaminated water, contemporary research has directed its focus towards the transformation of a potential natural waste into Activated Carbon which has gained popularity as a method of eliminating heavy metals from wastewater due to improvements in production methods to create eco-friendly adsorbents which has shown to be effective in the adsorption of heavy metals. The agricultural waste under investigation will be "Chayote/Squash/Eskos" plant i.e. leaves and stems which will be undergoing chemical activation using a range of chemical activating agents to compare its removal efficiency of the heavy metals (lead, zinc, manganese), via Adsorption. Further characterization gives us a more detailed knowledge on the properties of the surface of the Activated Carbon to assess and understand its structural properties, which directly influence its performance in adsorption processes.*

Keywords*: Heavy metal, Activated Carbon, Chayote, Cost Effective, Adsorption.*

Production of activated carbon from Sechium Edule Plant for Removal of dyes and Fluoride Pollutants

Neilanuo Huozha[1,*], Nikili K zhimo[1], Daniel Kibami[1], T. Moaienla Ao[2]

[1]Department of Chemistry, Kohima Science College (Autonomous) Jotsoma, Nagaland, India
[2]Department of Chemistry, Patkai Christain College, Chümoukedima-Seithekema, Nagaland, India
**Corresponding Author: neilahuza@gmail.com*

ABSTRACT: *As public awareness and water quality standards increase, managing and treating wastewater has become increasingly complex. Industrial and agricultural activities contribute significantly to water contamination, and although various treatment methods are employed, they often incur high costs, lack efficiency, and generate secondary waste products. Consequently, there is a pressing need to develop cost-effective and environmentally sustainable water purification methods. One promising approach is the use of adsorption, where researchers are investigating the production of activated carbon from low-cost materials as a substitute for expensive commercial activated carbons. This strategy aims to enhance the adsorption capacity of activated carbon through chemical surface modifications. The focus is on creating chemically activated carbon from the leaves and stems of the Sechium edule plant, commonly known as "Chayote," to effectively remove fluoride and dye pollutants from water. This method not only addresses waste disposal issues by converting potentially wasteful by-products into valuable adsorbents but also provides a sustainable solution for future wastewater treatment.*

Keywords*: Activated carbon, Adsorption, Water treatments, Chemical activation.*

Computational Thermodynamics - and Machine Learning-based Screening of Deep Eutectic Solvents for the Extraction of Lithium from Low-Concentration Sources

Shrihari M S, Appurva K, Sudhir H Ranganath*
Department of Chemical Engineering, Siddaganga Institute of Technology, Tumkur, India
**Corresponding Author: sudhirh@sit.ac.in*

ABSTRACT: *Rising demand for Lithium could push global consumption to 5.11 million Mt by 2050, risking depletion of land-based reserves by 2080. To address this, methods to extract lithium from low-concentration sources like seawater and desalination reject water are in vogue. Deep Eutectic Solvents (DESs) are mixtures of Hydrogen Bond Acceptors (HBAs) and Donors (HBDs), defined by hydrogen bonding and non-ideal behaviour provide an effective, eco-friendly solution due to their tunability and selectivity for lithium recovery. With numerous possible combinations of HBAs and HBDs, screening for novel DESs often relies on trial and error which is time consuming and not scientific. Understanding molecular interactions and thermophysical properties is key to solvent development, making advanced theoretical and computational methods essential. We employed a four-part strategy: Machine learning was used to predict DES properties melting point and fusion enthalpy and generate Solid-Liquid Equilibrium (SLE) data. Infinite dilution activity coefficient (γ∞) was estimated using COSMO-RS to understand the non-ideal behavior. Hydrogen bonding and DES interactions were analyzed using Molecular Dynamics simulations. Density Functional Theory was employed to calculate the binding and Gibbs free energies of lithium ions with DES ligands to identify best HBA and HBD candidates. Initially, we used five HBA-HBD combinations containing various phosphine oxide groups as HBAs based on previous literature. As HBDs, we chose naturally-derived amino acids and sugars. The calculations revealed that all five combinations exhibited negative deviations from ideality and melting point depression, confirming the formation of DESs. Among them, the TOPO/Glucose combination showed the highest negative deviations (γTot = -3.386), resulting in a significant melting point depression (~160 K) compared to other DESs. Due to strong synergy between TOPO and Glucose, we selected this combination for further studies on energy interactions and lithium affinity in low-concentration environments.*

Keywords*: Deep Eutectic Solvents; Green Solvents; Solvent Designing; Machine Learning; Sustainability.*

Synergistic Extraction of Mn (II) Using TCAO and TBA

A V L N S H Hariharan*, Luma Tulasi
Department of Chemistry, GITAM Institute of Science, India
**Corresponding Author: ulatyabu@gitam.in*

ABSTRACT: *Synergistic extraction (SX) of Mn(II) from sulphuric, nitric, hydrochloric and perchloric acid solutions containing a mixture of Organic extractants- Tri-Capryl amine oxide (TCAO) and Tribenzyl amine (TBA) in xylene has been studied. The investigations were first performed to select optimal conditions for the effective separation including pH of the aqueous phase as well as concentration of synergistic mixture. Stoichiometries of extracted species in both individual and mixed extraction were ascertained by slope ratio analysis. Thermodynamic parameters controlling the nature of the extraction were also evaluated from the distribution ratio values obtained at different temperatures in order to explain the extraction mechanism.*

Keywords*:*

Ultrasonic-assisted Leaching of Metals from Refinery Waste Catalysts Using Nitrilotriacetic Acid as a Leaching Agent

Ashish Pathak*, Hanadi Al-Sheeha, Sakeena Al-Sairafi, Bader Al-Arbeed, Mohan S. Rana

Petroleum Research Center, Kuwait Institute for Scientific Research, Kuwait

**Corresponding Author: apathak@kisr.edu.kw*

ABSTRACT: *The waste catalysts discarded from the hydroprocessing unit of petroleum refineries contain high amounts of valuable metals such as Ni, V, Mo, Al, Co, etc. Due to the stringent disposal standards and the necessity of finding secondary sources for these metals, the recycling of waste petroleum catalysts has become a feasible management strategy for refiners. In this work, we employed ultrasonic-assisted leaching to leach valuable metals from waste petroleum catalysts using nitrilotriacetic acid (NTA) as a leaching agent. The waste catalysts were collected from a hydroprocessing unit of the refinery and found to contain different metals (Ni, V, Mo, and Al). The presence of these elements was also confirmed through the Energy Dispersive X-ray Spectrometer (EDS) analysis. The ultrasonic-assisted leaching experiments using NTA were conducted in an ultrasonic bath (Soltec 5300 EP S3) having 38 KHz frequency. The experiments were performed using an aqueous solution of 0.25 molar NTA solutions under the following operating conditions: reaction temperature 60 ℃, revolution min-1 - 150, pulp density – 25 g/L, time 3 h. The leaching results suggest that ultrasonic-assisted leaching using NTA was effective and can leach 60.2% Mo, 57.7%V, and 42.3% Ni within 2 h of the reaction period while preventing dissolution of Al support (<20%). The results suggest that ultrasonic-assisted leaching is an effective method to leach valuable metals from petroleum waste catalysts.*

Keywords*: Ultrasonic, metal, NTA, leaching, waste catalysts.*

Acid-Functionalized Cotton Plant Biomass for Methylene Blue Dye Removal

Anand Patel*, Jignesh Valand

Department of Materials Science, Sardar Patel University, Vallabh Vidyanagar, Gujarat, India

**Corresponding Author: anandmpatel2000@spuvvn.edu*

ABSTRACT: *Researchers are presently working on removing synthetic dye from industrial waste water using various low-cost adsorbents to achieve environmental and economic sustainability. In the present work, methylene blue dye was removed from the aqueous solution using the cotton plant biomass waste-derived bio-adsorbent. Bio-adsorbent was prepared by chemical treatment of sulfuric acid (H2SO4). The batch method was applied for the methylene blue dye adsorption experiments for dye removal application from the aqueous environment. The adsorption parameters such as adsorbent dosage, solution pH, contact time and initial dye concentration were studied. The point of zero charge (PZC) of the prepared bio-adsorbent was measured using the salt addition method. FTIR spectra revealed the presence of acid functional groups in bio-adsorbent at 1710cm-1 and 1100cm-1 after sulfuric acid treatment. Bio-adsorbent exhibits excellent stability and high adsorption due to abundant porous structures and a large number of oxygen-containing functional groups. After utilizing pseudo-first order and pseudo-second order kinetic models to analyze the adsorption experimental data, it was found that the pseudo-second-order kinetic model provided a better understanding of the kinetic behaviour of the sorption process. Moreover, the adsorption equilibrium was well described using the Freundlich isotherm model. This work shows that cotton waste bio-adsorbent is a promising acid-functionalized bio-adsorbent for removing methylene blue dye.*

Keywords*: Cotton waste biomass, Sulfuric acid, Bio-adsorbent, Methylene blue dye.*

Valorisation of Banana Bract (A Banana Industry Waste) for Extraction of Anthocyanin

Deblina Sen*, Dolanchapa Sikdar, Shairee Ganguly
Department of Food Technology, Guru Nanak Institute of Technology, India
**Corresponding Author: sendeblina2016@gmail.com*

ABSTRACT: *Banana bracts are usually considered food waste, but in recent days, banana bracts are being investigated as a latent source of natural colorant. This natural colorant can be used in various beverages, baked goods, dry mixes, dairy products, confectioneries, pet foods, and different kinds of other products. The bracts of edible banana species are rich in 3-diglucoside pigment with four types of anthocyanidins: cyanidin-pelargonidin; cyanidin-delphinidin; delphinidin-petunidin-cyanidin-malvidin-peonidin and malvidin-peonidin. This paper studies the effects of different solvents for the recovery of anthocyanin from banana bracts. The antioxidant properties of the anthocyanin pigments are also evaluated by using FRAP, DPPH and ABTS assays. The results obtained showed that the anthocyanin content in the banana bract extract ranges from 0-1.80 mg per gram of dried sample. Regarding the antioxidant properties, the following results were observed: a) for FRAP assay, values ranged from 6.29-38.41 µmol of Trolox equivalents per g of dried sample (µmol TE/g); b) DPPH-radical scavenging ranged from 12.19-52.83 µmol TE/g and c) values ranged from 14.98-65.82 µmol TE/g were detected in ABTS assay. This paper also studies the presence of different phytoconstituents in the extract. Furthermore, the changes in the stability of anthocyanin at various pH ranges (pH 2 to pH 10), different temperatures and in the exposure to light are evaluated here.*

Keywords*: Banana Bracts, Anthocyanin, Antioxidant, Phytoconstituents, Stability.*

Industrial Plant Maintenance Activities Integrated with Condition Monitoring Data for Improved Decision Making in an Industrial Equipment Maintenance

Sreerama Meraka[1,*], TV Hanumantharao[2], Ravindra Andukuri[3], P. Vijayakumar[1]
[1]Mechanical Engineering Dept., Raghu Engineering College (Autonomous), Visakhapatnam, India
[2]Mechanical Engineering Department, Anil Neerukonda Institute of Technology and Sciences (Autonomous), Visakhapatnam, India
[3]Gitam School of Tehnology, Gitam University, India
**Corresponding Author: Sreerama.meraka@gmail.com*

ABSTRACT: *Industrial Plant Means Arrangement of Heavy Machinery, Equipments, & Apparatus for Production process. Plant Maintenance is a crucial job for operating and Maintenance Department. In Engineering Practice, Maintenance of Heavy Machinery like Turbines, Motors, Compressors, Blowers, Generator units, Gearboxes and Pipelines etc. There are different methods are available for Maintenance namely Periodic maintenance, Preventive maintenance, Breakdown maintenance etc. In many cases maintenance team experience new issues regarding Trouble shooting and repairs of equipments. Especially interms of Decision making of replacing parts, lubrication intervels, Downtime schedules of machinery. Condition Based Maintenance is an equipment maintenance strategy based on measuring the condition of equipment in order to assess whether it will fail during some future period, and then taking appropriate action to avoid the consequences of that failure. This paper explores how condition monitoring data can be effectively used to enhance maintenance strategies and operational efficiency.*

Keywords*: Plant, Condition Monitoring, Plant Operations, Maintenance, Data Acquisition.*

Interwoven Architectural Complexity in Ni(II) Ion-Based 3D MOF Using Bipyridine and Tetrabenzenecarboxylic Acid: Adsorption Insights in Highly Efficient Iodine and Cationic Dye Capture

Shaikh Arfa Akmal, Mohd Khalid*

Functional Inorganic Materials lab (FIML), Dept. of Chemistry, Aligarh Muslim University, Aligarh, India

**Corresponding Author: khalid215@gmail.com*

ABSTRACT: *In this study, a nickel-based metal-organic framework (Ni-MOF), designated as AR-1, was synthesized using 1,2,4,5-benzene tetracarboxylic acid (H4btc), 4,4'-bipyridine (4,4'-bipy), and nickel nitrate through a hydrothermal process. The AR-1 structure was characterized by various techniques, including elemental analysis, Single Crystal X-ray Diffraction (SCXRD), Fourier Transform Infrared Spectroscopy (FTIR), and Powder X-ray Diffraction (PXRD). SCXRD revealed a three-dimensional framework stabilized by water molecules through hydrogen bonding. AR-1 demonstrated efficient and reversible iodine adsorption in vapor and solution phases, with a maximum 580 mg/g uptake. This adsorption is driven by physisorption and chemisorption and strong interactions between iodine and the π-electron-rich aromatic ligands in the MOF. In wastewater treatment, AR-1 exhibited selective adsorption of cationic dyes, such as Methylene blue, from aqueous solutions while showing minimal affinity for neutral or anionic dyes like Martius yellow and Congo red. Notably, the MOF retained its high adsorption performance after several regeneration cycles, showcasing its reusability. The water stability and pH resistance of AR-1 make it a promising candidate for treating contaminated water, effectively removing both radioactive iodine and organic dye pollutants. This work paves the way for optimizing MOF-based materials for broader applications in wastewater treatment, addressing complex pollution scenarios involving radioactive and organic contaminants.*

Keywords*: Nickel-based MOF, wastewater treatment, iodine adsorption, dye removal, environmental remediation.*

Abrasion Resistance and Chemical Durability of Pervious Concrete Incorporating Reclaimed Asphalt Pavement through Optimized Treatment Durations

Gyanen Takhelmayum*, Konsam Rambha Devi

Department of Civil Engineering, Manipur Institute of Technology, Manipur University, Imphal, Manipur, India

**Corresponding Author: gyanen.jnnce@gmail.com*

ABSTRACT: *This research explores the impact of treatment durations regarding the durability of pervious concrete (PC) integrating Reclaimed Asphalt Pavement (RAP) during the standard 28-day curing cycle. The research evaluates treatment durations of 0 months, 12 months, and 24 months, across RAP replacement ratios various from 0%, to 100% with the incremental of 25%. Cantabro abrasion test data demonstrate significant mass loss in untreated RAP, with 100% RAP exhibiting a mass loss of 35%. After 12 months of treatment, mass loss decreases to 33%, with further reduction to 32% following 24 months of treatment. Additionally, chemical durability assessments under chloride and sulphate exposure reveal increased susceptibility of RAP-modified concrete to sulphate-induced degradation, with 100% RAP showing the highest vulnerability. The findings highlight the critical role of extended RAP treatment in improving both abrasion resistance and chemical resilience of pervious concrete, with the most pronounced enhancements observed during the early treatment period..*

Keywords*: Pervious concrete, Cantabro abrasion, chloride and sulphate exposure.*

Technology of Sorption Treatment of Sludge from Heavy Metals (for Georgian WWTP)

Nino Takaishvili[1,*], Natela Dzebisashvili[2,3,*], Sadhan Kunar Ghosh[4], Tamar Davitaia[3], Darejan Dughashvili[2,3]

[1]Ivane Javakhishvili Tbilisi State University, 3 Ilia Tchavtchavadze Avenue, Tbilisi, Georgia
[2]Institute of Hydrometeorology at Georgian Technical University, Tbilisi, Georgia;
[3]Rafiel Agladze Institute of Inorganic Chemistry and Electrochemistry of Ivane Javakhishvili Tbilisi State University, Mindeli Str., Georgia
[4]Sustainable Development & Amp; Circular Economy Research Centre, ISWMAW, India

**Corresponding Author: nino.takaishvili@tsu.ge*

ABSTRACT: *Modern urban wastewater treatment methods are conjugated with sludge formation, which in turn requires their rational management, otherwise there will be unlimited accumulation of sludge at Wastewater Treatment Plants (WWTP), which will lead to economic and environmental problems. In this regard, today, the utilization of sludge is considered a priority task for research and development in this area. There are two methods of sludge management: Reuse of substances in circulation (recycling); Removal of substances from circulation (elimination). Sludges have various critical properties/components that prevent their direct return to the circulation of substances or their removal from it. As a result, sludge need to be treated to change the critical properties/components so that hazardous impurities no longer have a critical impact on the environment. The goal of our study was to identification of harmful impurities in sludge and study of the technical possibility of extracting these impurities from sludge by using some natural sorbents at one of the stages of wastewater purification on WWTP. As part of the study, it was proposed a combined water and sludge purification based on the pumping station of WWTP, namely: a rotating metal carousel-type suspension with mesh containers (mesh size <1200 μm) into which a specified amount of zeolite is placed (zeolite particle size >1200 μm), the renewal of which depends on the amount of sorbent, as well as on the quality of the cushioning of the material used. Testing of the developed methodology in laboratory conditions showed that using this technology, the content of studied heavy metals in sludge is reduced by 30-50%.*

Keywords*: WWTP, Sludge, Heavy Metals, Sorbents, Treatment.*

Prospects for the Production of Geopolymer Materials based on Industrial Waste

Elena Shapakidze[1,*], Marina Avaliani[2], Marina Nadirashvili[1], Vera Maisuradze[1], Ioseb Gejadze[1], Tamar Petriashvili[1]

[1]Ivane Javakhishvili Tbilisi State University, Alexander Tvalchrelidze Caucasian Institute of Mineral Resources. 11 Mindeli Str., Tbilisi, Georgia
[2]Ivane Javakhishvili Tbilisi State University, Raphiel Agladze Institute of Inorganic Chemistry and Electrochemistry, 11 Mindeli Str., Tbilisi, Georgia

**Corresponding Author: elena.shapakidze@tsu.ge*

ABSTRACT: *The use of geopolymer materials (GPM) to replace ordinary Portland cement (OPC) has become a trend in recent decades due to the extremely negative environmental condition of our planet as well as the huge accumulation of industrial waste all over the world. During the production of GPM, industrial waste (metallurgical slag, ash from fuel combustion, etc.) is utilized, on the one hand, and greenhouse gas emissions are reduced by 80% compared to production with OPC. The slow transition from OPC to GPM production in the construction industry holds great promise for the environment. Currently, the global cement industry accounts for 7 to 10% of global carbon dioxide emissions due to the necessary calcination of limestone in the cement production process, with approximately 1 ton of CO2 emitted into the atmosphere for every ton of Portland cement produced. GPMs offer a low-CO2 alternative, and given that geopolymer concretes are generally stronger and more durable, they offer a longer design and service life, reducing the need for natural raw materials in the future. Recycling of industrial waste helps to free areas from pollution and helps to restore the ecological balance of the environment. The present work is devoted to the study of the possibility of obtaining GPM with optimal properties based on fly ash (FA) - coal combustion waste from the Kutaisi Thermal Power Plant (Georgia) and ground granulated blast furnace slag (GBFS). For this purpose, various FA activation methods were used: mechanical, thermal and chemical. FA activation parameters were established and GPM compositions were determined.*

Keywords*: geopolymer material (GPM), ordinary Portland cement (OPC), fly ash (FA), granulated blast furnace slag (GBFS), industrial waste.*

Carbonate Precipitation in Steel Slag for its Activation and Conversion to Supplementary Cementations Material

Dilip Makhija*, Priyapratim Patra, Jagabandhu Kole, Manoj Rustagi
JSW Cement Ltd, India
**Corresponding Author: dilip.makhija@jsw.in*

ABSTRACT: *The global steel production touched almost 2 billion tons in year 2023 with a major share of the production coming from the BF-BOF route. The steel production in EAF and BOF produce roughly 180 Kg of slag for every ton of crude steel produced. Both BOF slag and EAF slag contain mineral phases such as Dicalcium silicate, Magnesio Wustite and Calcium alumino ferrite. The steel slag also contains free lime CaO and periclase MgO phases both of which tend to hydrate and expand when exposed to moist conditions. Due to the presence of iron impurities in slag, the dicalcium silicate phase crystallizes in the a' form which is non-reactive as a binder.The mineralogy of steel slag makes it unsuitable for application in either cement or any application of aggregates in fine or coarse form during preparation of concrete. Application in cement blending requires activation of steel slag phases such that upon hydration the dicalcium silicate phase contributes to binding activity. Similarly, the free lime and periclase phases need to be stabilized for minimizing the problems of delayed expansion.The unreactive calcium oxide phase and the free lime in steel slag was carbonated in laboratory experiments such that the calcium oxide precipitates out in the form of calcium carbonate. Characterization studies were carried out through XRD, chemistry determination, FTIR and optical microscopy to study the change in mineralogy of steel slag after carbonation. The studies revealed that with an increase in the fineness of steel slag and the carbonation time the degree of carbonation of steel slag also increased. The carbonated steel slag was then tested for mortar tests and compared with the control steel slag sample which was un-carbonated for evaluation of compressive strength, setting time, water permeability, rapid chloride permeability and other tests. The tests revealed that carbonated steel slag had a better resistance to chloride and water penetration, better compressive strength with a slight decrease in setting time.*

Keywords*:*

Green Synthesis of Silver Doped Zinc Oxide / Magnesium Oxide Nanoparticles and its Adsorptive Studies on Removal of Congo Red Dye

Kolluru Sree Manaswini*, G. Jyothee Pallavi, N. Chitti Babu
Department of Chemical Engineering, Andhra University, Visakhapatnam, India
**Corresponding Author: kollurumanaswini@gmail.com*

ABSTRACT: *The present study, aims to exploit the experimental determination of biosorptive characteristics of synthesized silver doped zinc oxide/ magnesium oxide nanoparticles (Ag doped ZnO/MgO-Np's) with mentha piperita green leaf extract. Synthesized Ag doped ZnO-/MgONp's were characterized by SEM, XRD FTIR and EDX analysis. The resultant nanoparticle size obtained is 122nm. The process variables such as Agitation time, Initial concentration of CR dye, pH, Dosage of Ag doped ZnO/MgO-Np's and Temperature were performed and compared by using response surface methodology (RSM). At the optimized parameter conditions, the dye adsorption was studied from Isotherms, Kinetics and Thermodynamics, respectively. At the optimized conditions, maximum removal (94.3%) of CR dye obtained. It was found that the Freundlich-isotherm, pseudo second order kinetics fitted the data better as compared to other isotherm and kinetic models. The results of thermodynamic studies exhibits the exothermic nature, thermodynamically feasible nature of adsorption.*

Keywords*: Mentha piperita, Congo red, Ag doped ZnO/MgO-Np's, Isotherms, Kinetics.*

Removal of Lead Ion (II) from Solid Waste Site Contaminated Water Using Silver Nanoparticle Impregnated Natural Water

Rashidul Alam[1], Ajay Bharti[1], Binod Pokhrel[2,*], S Robert Ravi[3]

[1]North Eastern Regional Institute of Science and Technology, Department of Civil Engineering, Arunachal Pradesh, India
[2]State Water Quality Testing Laboratory, Public Health Engineering & Water Supply Department, Arunachal Pradesh, India
[4]Girjananda Choudhury University, Guwahati, Assam, India
**Corresponding Author: dr.binodpokhrel@gmail.com*

ABSTRACT: *This study showcases the development of an eco-friendly, cost-effective adsorbent derived from coir fiber, modified with silver nanoparticles (AgNPs) to remove lead (Pb^{2+}) ions from contaminated water sources. The synthesis process involved the reduction of silver on the coir fiber surface, followed by heating at 250°C to enhance stability and adsorption efficiency. Characterization through SEM (Scanning Electron Microscopy), XRD (X-ray Diffraction), and TEM (Transmission Electron Microscopy) confirmed the material's structural features and the successful integration of AgNPs. Key findings from the adsorption experiments highlighted the effects of parameters like contact time, pH, and initial concentration on Pb^{2+} adsorption performance. The adsorption capacity improved with longer contact time, higher initial Pb^{2+} concentration, elevated temperature. However, increased adsorbent dosage led to a decrease in adsorption capacity, likely due to aggregation or reduced active sites per unit mass. Optimal conditions were identified as 500 mg/L initial Pb^{2+} concentration, pH ≤ 7, 90 minutes of contact time. Under these conditions, the AgNP-modified coir fiber exhibited strong potential as a sustainable adsorbent for removing Pb^{2+} from water. This material offers a promising solution for reducing lead contamination in wastewater, contributing to safer and cleaner water resources.*

Keywords*: Coir Fiber, Lead (II) ion, Adsorbent, Contact time.*

Review of air Pollution Treatment from Industry Discharges

Engr. Hakeem V. Canonio*

Department of Agricultural and Biosystems Engineering, College of Engineering and Technology, Tarlac, Agricultural University, Philippines
**Corresponding Author: h_canonio@tau.edu.ph*

ABSTRACT: *Management and control of air pollutants from industry discharges are categorized as either source reduction, containment, or removal by treatment technologies. Source reduction includes identification of every source within the industry facility, substitution to non-polluting material, preventive maintenance, spill prevention plans and procedures, and updating emergency response facilities. Containment being the most cost-effective includes maintaining the negative pressure of the building insides, isolation chambers, and ductwork. Treatment technologies being the last resort due to being cost-extensive include electrostatic precipitators, fabric filters, gravity separators, inertial separators, and wet scrubbers. Treatment systems to control and/or remove gaseous pollutants from the gas stream follow the concepts of absorption, adsorption, bio filtration, condensation, and incineration. Absorption in general uses wet scrubbers as the main equipment which brings air in contact with liquid. Substances dissolved into the liquid are then separated from the gas stream. Adsorption utilizes activated carbon due to its high surface reactivity and micro porous structure. Silica gel and molecular sieves are also good candidates depending on the pollutant. Bio filtration employs the dissolution of contaminants within water where it is biodegraded. Gas containing sulphur generally utilizes the condensation method which removes heat from the gas stream following the generalized ideal gas law. Finally, incineration is based on the combustion of organic pollutants to convert them into safer substances mainly ash, carbon dioxide, and water. Inorganic ones however are usually blended in the ash which in turn is a challenge in disposal.*

Keywords*:*

Circular Economy of Waste and By-products: Innovative Case Studies and Climate-Forward Strategies for Sustainable Industrial Models

P. Venkateswaran[1,*] , Sadhan K Ghosh[2], Prasanta K. Dey[3]

[1]Sri City Pvt Ltd, Sri City, Andhra Pradesh, India
[2]International Society of Waste Management, Air and Water (ISWMAW), Kolkata, India.
[3]Aston Business School, Aston University, Birmingham University, Birmingham, UK

**Corresponding Author: venkat.p@sricity.in*

ABSTRACT: *The transition to a circular economy (CE) is essential for achieving sustainability in industrial park operations. This paper explores innovative strategies that utilize waste and by-products to create sustainable economic models. By examining multiple case studies, we highlight successful implementations of CE principles that not only reduce waste but also enhance resource efficiency and foster economic resilience. Through analysis of various industrial parks globally, we identify key practices such as waste valorisation, closed-loop systems and renewable energy integration, etc. These strategies show how industries can repurpose waste materials into valuable resources, minimizing environmental impact while maximizing economic potential. The case studies illustrate approaches to transforming industrial by-products into new materials for construction and manufacturing, addressing the demand for fresh materials. Furthermore, this paper discusses the roles of policy frameworks, stakeholder collaboration, and technological innovations in facilitating the shift towards a circular economy. Ultimately, the findings underscore the importance of adopting CE principles as foundational elements of sustainable industrial models, providing a roadmap for industries aiming for long-term sustainability while tackling pressing environmental challenges. This research contributes to the discourse on sustainable industrial practices and offers actionable insights for policymakers and business leaders.*

Keywords*: Reverse logistics, Climate change, Waste management, Circular Economy, Eco-practices.*

Utilization of Dolochar an Industrial Waste in Cement Plants

Rahul Baidya[1,*], Sadhan Kumar Ghosh[2]

[1]Centre for Research and Innovation, Department of Mechanical Engineering, Institute of Engineering & Management, School of University of Engineering and Management Kolkata, India
[2]International Society of Waste Management, Air and Water, Kolkata, India

**Corresponding Author: rahulbaidya.ju@gmail.com*

ABSTRACT: *Dolochar is a by-product of sponge iron industry, produced in large volumes, for every 100 tons of sponge iron produced around 25 tons of dolochar is generated as a by-product in direct reduction of iron (DRI) type plants. And India being the largest producer of sponge iron, managing these waste by-products is a challenge, as it requires an effective disposal in accordance with the environmental guidelines. This study thus explores a sustainable solution by using dolochar as an alternative fuel (AF) in captive power plant (CPP) and for slag dryer in the cement plants, aiming to reduce both environmental impact and production costs in cement manufacturing by substituting traditional fuels. The dolochar as an AF was experimentally analysed through a trial for a year and the techno-economical sustainability of the process was gauged based on the substitutional benefits. The environmental sustainability was also gauged through measurement of different emission during the trial period. The findings showed that dolochar can be successfully integrated into cement plants without compromising the process or environmental safety. By using dolochar, cement plants consume less fossil fuel, leading to cost savings and a significant reduction in greenhouse gas emissions. During the study period around 18400 tons of dolochar was utilized in CPP and in slag dryer with savings of around USD 185113. Thus, the utilization of dolochar provides a sustainable way for reduction of carbon footprint of the cement plant while conserving resources and enhancing circular economy through resource re-circulation.*

Keywords*: Dolochar, Cement Plants, AFRs, Waste Utilization*

Design and Development of IoT - Enabled Industrial Emissions and Air Quality Surveillance

Malla Prakash, Sireesha Tankala, P.Kanaka Raju*
GITAM School of Sciences,GITAM, Visakhapatnam, India
**Corresponding Author: kpappala@gitam.edu*

ABSTRACT: *In the contemporary era, air pollution has emerged as an insidious and far-reaching challenge, casting a shadow over the advancements of modern civilization and posing a profound threat to both human well-being and the delicate ecological balance of our planet. In industrialized societies, effective monitoring and management of pollutants emitted by industrial processes are critical for environmental sustainability and public health. This paper introduces an innovative method for monitoring industrial pollutants and Air quality index through sensors associate with Internet of Things (IOT) technology. Our IOT-based system employs a network of distributed sensors strategically placed within industrial facilities to capture real-time data on pollutant emissions.*
The primary objective of this research is to enhance the accuracy, efficiency, and timeliness of pollutant monitoring compared to traditional methods. We discuss the design and implementation of our IOT infrastructure, which includes sensor selection, data collection mechanisms, and communication protocols. Through extensive field tests and case studies, we demonstrate the effectiveness of our IOT-based monitoring system in detecting pollutants and providing immediate notifications of abnormal emissions. Our results reveal a significant reduction in response time for identifying pollution incidents, leading to improved industrial process control and reduced environmental impact.This study contributes to the advancement of industrial pollutants monitoring by controlling the capabilities of IOT technology. The proposed system offers a versatile and scalable solution for regulatory compliance, environmental management, and sustainable industrial practices. By embracing IOT for pollutants monitoring, industries can enhance and contributing to a cleaner and healthier future.

Keywords*: Sensors, Controllers, communication devices, cloud-based platform.*

Addressing Labor Challenges in Ship-Generated Hazardous Waste Handling at Indian Ports: Ensuring Safety and Best Practices

Abhijit Mohite*
School of Maritime Management, Indian Maritime University, Chennai, India
**Corresponding Author: 87.abhijit@gmail.com*

ABSTRACT: *There are considerable labor problems posed by the management of ship-generated hazardous waste at Indian ports, which in turn affects the health of workers and the safety of the environment. This study examines the various hurdles in managing hazardous waste with a focus on the lack of capacity and capability in regulations, safety, and training of workers constituting their exposure to vulnerabilities. The mixed-methods research combines the findings of quantitative surveys with qualitative data available from other studies seeking to advance the current research. The main findings suggest that lack of knowledge and poor training regarding the procedures in place for the management of toxic wastes increases the chances of accidents and health risks to the workers. In addition, the barriers of inadequate sac management by cupboards and proper work settings elevate the need for improvement of these safety standards. There are recommendations on the need for effective enforcement of the safety regulations, instituting proper mechanisms to prevent any form of infringements including instituting boring offer unexpected monitoring systems, and providing well-written orientations on safe working practices. They attempt to highlight the policies that allocate labor to preserve the environment and the policies promoting the slumber of the working and at the same time contribute to the depolarization of the waste in the maritime industries. Therefore, this study brings forward a need to consider an integrated perception, which comprises regulation, democratic processes, and community participation in addressing hazard issues as a complex.*

Keywords*: Ship-generated hazardous waste, Labor challenges, Indian ports, Waste management, Worker safety, Safety protocols.*

Effect of Ammonium on Copper Recovery under Fluidized Bed Homogenous Crystallization System

Josel Godezano[1,*], Delia B. Senoro[1], Ming-Chun Lu[2]

[1]Mapua University, Philippines
[2]Department of Environmental Engineering, National Chung Hsing University, Taiwan
**Corresponding Author: godezano1983@gmail.com*

ABSTRACT: *This study explores the effect of Ammonium (NH4+) on Copper recovery under the Fluidized Bed Homogenous Crystallization (FBHC) System at varying pH conditions at MR Cu2+/NH4+ = 1. Results indicated that NH4+ exerts negligible effects on the removal of copper, maintaining a consistent removal efficiency exceeding 99% across all pH conditions. Nonetheless, the process of copper recovery experiences a decline with an increase in pH levels due to the deprotonation of ion species pivotal to the system. The relationship between the recovery rate of Cu^{2+} and pH displays a distinct correlation. Optimal recovery efficiency, reaching 99.12%, is evident at pH 6.5, while a decrease is observed with increasing pH, reaching its lowest effectiveness at pH 10 (77.53%). This phenomenon indicates that variations in pH significantly impact the granulation process. On the other hand, the removal of NH4+ improves significantly as pH increases, peaking at pH 10 with 96.54%. Higher pH levels are more favorable for the removal process. However, NH4+ recovery decreases with increasing pH, being highest at pH 6.5 (36.17%) and lowest at pH 10 (4.91%). This suggests that the recovery process is less efficient at higher pH levels. Furthermore, an FTIR spectroscopy analysis unveiled that the bands associated with P=O and P-O functional groups remained distinctly observable at 1049 cm-1 and 604 cm-1, respectively, across the pH condition, regardless of the pH variations. Subsequent X-ray diffraction (XRD) investigations showcased distinct peaks in the XRD pattern closely resembling the standard reference pattern of Cu4H(PO4)3•3H2O, where the presence of ammonium remained elusive owing to the adsorption mechanism prevailing within the FBHC system. In addition, scanning electron microscopy (SEM) images illustrated the surface morphology characterized by a spherical yet porous structure, while a substantial concentration of ammonium was found to significantly undermine the structural robustness of the granules, ultimately resulting in brittleness of the granular material.*

Keywords*: fluidized bed, homogeneous crystallization, recovery, granulation.*

A review on separation of oil from industrial effluent by adsorptive materials

Harish Paliwal, Shyam Kodape*

Department of Chemical Engineering, Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India
**Corresponding Author: smkodape@che.vnit.ac.in*

ABSTRACT: *The release of oil pollutants from industrial effluents is a growing environmental concern, driven by the increase in industrial activity and frequent oil spills. Adsorptive techniques have gained prominence as efficient and eco-friendly solutions for separating oil from wastewater. This paper reviews various adsorptive materials, such as natural fibers, synthetic polymers, and nanomaterials, used to remove oil from contaminated water. A detailed analysis of the factors influencing adsorption efficiency, such as surface area, porosity, and surface modification of the adsorbents, is presented. The comparative studies of adsorption capacities and regeneration potential offer insights into large-scale applicability, making adsorptive methods a promising solution for treating oily effluents. Future directions in adsorbent development are explored to enhance both the practicality and sustainability of oil separation technologies.*

Keywords*: Oil separation, Adsorption, Effluent, Eco-friendly, Hydrophobic materials.*

Studying Rheology of tannery waste liquor using artificial neural networks

Sarah Tarek Ghaly[1], M.F. Abadir[1], M.A. Sorour[2], F.I. Barakat[1]

[1]The Chemical Engineering Department, Faculty of Engineering, Cairo University
[2] Food technology research Center

**Corresponding Author: sarahtarek04@gmail.com*

ABSTRACT: *Studying the rheology of tannery waste is crucial for proper management of that waste especially estimating the power requirements of various devices need for transportation into the waste water treatment unit such as agitators and pumps. An artificial neural network (ANN) model was developed to facilitate this study. The model takes the concentration of the tannery waste suspension, shear rate, and temperature as input variables, and outputs the viscosity and shear stress of the waste. A comparison with experimental data shows that the ANN model closely aligns with a mean square error (MSE) of 0.0003, 0.0001 and a goodness of fit (R^2) of 0.9999, 0.9945 for shear stress and viscosity respectively. These results validate the use of ANN models for examining the rheology of tannery waste, demonstrating that the developed ANN model can accurately predict the viscosity of tannery waste in the drain line, a task that standard curve fitting methods fail to achieve.*

Keywords*: Artificial neural network, tannery waste, shear stress, viscosity.*

Assessment on the Effects of Iron in Nickel Carbonate Granulation

Viatto Leonard D. Palangana[1], Ming-Chun Lu[2,*], Florencio C. Ballesteros[1]

[1]Environmental Engineering Program, National Graduate School of Engineering, University of the Philippines-Diliman, Quezon City Philippines
[2]Department of Environmental Engineering, National Chung Hsing University, Taichung City, Taiwan (R.O.C)

**Corresponding Author: vdpalangan@up.edu.ph*

ABSTRACT: *The effect of Iron (II) in Nickel Carbonate granulation in the fluidized-bed homogenous crystallization (FBHC) system was determined, leveraging a facecentered Central Composite Design with varying Carbonate-to-Nickel (II) Molar Ratio (1.5-2.0), pH (8.5-9.5), and Iron (II) concentration (0.36 mM-1.07 mM). Nickel is an extensively regulated heavy metal due to its detrimental effects on humans and the environment. It has the potential, just like other heavy metals, to bioaccumulate and biomagnify in biota. In the FBHC set-up, the synthetic wastewater tank contained Nickel (II), and Iron (II), and carbonate for the precipitant tank, with each run lasts for 168 hours while having a flow rate of 20 ml/min and a reflow rate of 60 ml/min. Atomic Absorption Spectroscopy is utilized to determine the Nickel Granulation and Removal, and Iron Granulation and Removal. Increasing Iron concentration diminishes the Nickel Removal Efficiency (94% to 93%), and Granulation Efficiency (88% to 87%). The diminishing effect is due to the competition between the Nickel and Iron to form bonds with carbonate. The Nickel removal (94% to 95%), and granulation (88% to 92%) refines in increasing carbonate-to-nickel molar ratio due to a higher availability of carbonate ions. Thus, Iron (II) competes with Nickel (II) to form precipitate, but increasing the carbonate-to-Nickel molar ratio diminishes this effect. The study provides insight in recovery of Nickel in wastewater with the presence of other coexisting ions.*

Keywords*: Nickel Carbonate, Iron (II), Carbonate, Molar Ratio, pH, Fluidized-bed homogeneous crystallization process*

Industrial Solid Waste Management Practices in Ota, Ogun State

David O. Olukanni *, Essien E. Mmenieabasi

Department of Civil Engineering, Covenant University, Canaan land, Ota, Nigeria

**Corresponding Author: : david.olukanni@cu.edu.ng*

ABSTRACT: *Industrialization is a necessity for a nation's economic evolution. One of the targets in goal 11 of the United Nations for the Sustainable Development Agenda is to reduce the adverse per capita environmental impact of cities and paying special attention to air quality, municipal and other waste management practices. The major objectives of this study are to characterize the components of industrial solid waste generated and identify the solid waste management practices adopted in Ota, Ogun State. Data was collected from both primary and secondary sources and a total of seventy-seven (77) questionnaires from industries in seven sectors were analyzed. This study shows that the production processes associated with all the industries involved an average solid waste generation quantity of 103kg daily by each industry. The result also brought forward that plastic and rubber waste comprising mainly of remnants of packaging materials had the highest volume of (38%) while (23%) was recorded for readily compostable waste. Other components identified were glass and metals (9%), aluminum (7%) and paper (10%). Concerning the method of solid waste management adopted, a greater number of industries (31%) practiced open dumping, (23%) made use of incineration, (13%) open burning whereas a few employed landfilling (12%), burying (7%) and (14%) claim to have contracted this activity. It is recommended that the Ogun State government should establish laws than barn industries from disposing recyclable waste at dumping sites and the amount of waste generated annually must be required by law to be reported and the reports must be audited.*

Keywords*: Industrial Solid Waste, Waste Composition, Industry Classification, Waste Management, Environmental Pollution, Sustainable Development*

Fabrication and Characterization of Ferromangenese Slag Nano Powders

Raghavendra Y, Srinivasu R, Karun Kumar Y, Vijay Kumar A

Raghu Engineering College, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: Raghava.306@gmail.com*

ABSTRACT: *In Ferromanganese alloy production, slags having considerable amount of manganese oxides and other elemental oxides available in huge form are typically discarded on slag heaps. Approximately million tons have accumulated on slag dumps and further million tons are added every year. These slags constitute an environmental risk but are also potential sources of valuable manganese if a suitable method of recovery could be found. Slag is generally dumped as lumps which are irregular, porous, somewhat lower in calcium content than blast furnace slags, and contains a significant content (~10wt%) of manganese within its glassy phase. Ferro manganese slag can be used in alloy industries, fluxes manufacturing, highway constructions and in alkali-activated materials. In this paper an attempt has been made to modify the slag lumps into nano structured particles using Ball Mill. The irregular, porous slag lumps can be altered to a fine powder by this technique. The nano structured slag was characterized for its particle size by using particle size analyzer, crystal structure, crystallite size and percentage of crystallinity by using X-Ray Diffractometer. It was found that the particle size got reduced from 60 µm to 148 nm for the period of 70 hrs.*

Keywords*: Ferromanganese alloy slag, nano structed particles, ball mill, X-ray diffractometer*

X.
Marine Aspects & Microplastics

Marine Oil Spill Waste Management- A Circular Economy Approach

Ivana Biswas*, Malini V. Shankar, Sheeja Janardhanan

Indian Maritime University, Visakhapatnam Campus, Sabbavaram Mandal, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: myself.ivanabiswas@gmail.com*

ABSTRACT: *Marine oil spill incidents have devastating effects on the country's economic status, human health, tainting water, soil, and ecosystem. Over the years, there have been notable strides in improving how to manage oil spills. Similarly, maritime law has made substantial changes regarding the management and compensation of oil spills. Remarkably, the waste volume generated by oil spills can sometimes exceed the original amount of oil by at least a factor of ten. This dramatic increase can result in considerable logistical difficulties and delays in clean-up efforts, potentially halting response actions. Effective waste management requires thorough planning, proper storage of oily waste, and efficient transportation to reprocessing facilities and landfills. India has encountered two significant oil spills in recent years, highlighting major operational challenges and gaps in national maritime law. This paper focuses on identifying the gaps related to oil spill waste management and proposes circular economy approach as a solution. The paper also highlights the need for public-private-partnerships, regulatory action to establish maritime law and policy frameworks that will enable strategies to manage oil spill waste efficiently and sustainably.*

Keywords*: Oil spill waste; Circular Economy Sustainability; Legislative Action; Public-Private-Partnership; Policy Framework.*

Evaluating the Untapped Potential of Marine Fungi from the Visakhapatnam Sea Coast for Degradation of Microplastic

Harshitha Marla, Kiranmayi Patnala*

[1]Biotechnology Division, Department of Life Sciences, School of Science, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: kpatnala@gitam.edu*

ABSTRACT: *In the present world, plastic usage has increased drastically because of its convenience. Beyond their use, plastics have become a significant cause of environmental pollution since they are difficult to degrade and accumulate in the ecosystem. Plastics can be broken down into microplastics (MP <5mm in size) by sunlight, oxidative stress, machinery, and pressure, and these are deposited into the water bodies and adversely affect ocean life and human health. Regular decomposition processes show adverse environmental effects, and to mitigate this problem, bioremediation is used to degrade the microplastic by various microbial species (bacteria, fungi, and algae). Plastic's most efficient microbial decomposition method is mycoremediation, facilitated by fungi suited to a saprophytic lifestyle, fungal enzymatic machinery, and their surface proteins. A large amount of microplastic waste exists in the Visakhapatnam coastal areas, and fungal strains capable of degrading the MP are isolated from them. So, this study concerns the degradation of High-Density Polyethylene (HDPE) (<100 microns) by marine fungi isolated from the Visakhapatnam Coastal site. In this study, we have isolated six fungal strains from the coastal site. Some of them can degrade MP more effectively when inoculated into the MSM media and incubated at 28°C for 35 days. This degradation process will be analyzed using FE-SEM by observing the cracks and pits formed on the MP surface after degradation. FTIR analysis will be performed to determine the chemical composition and measure the infrared spectra of polymers. Further, we elucidate these isolated strains' enzymatic assays and hydrophobin production.*

Keywords: *Microplastics, Bioremediation, Marine Fungi, Visakhapatnam coast, FE-SEM*

Microplastic Pollution in Groundwater near Three Landfill Sites in Kerala

Amal R, Suja P. Devipriya*
School of Environmental Studies, Cochin University of Science and Technology, Kerala, India
**Corresponding Author: devipriyasuja@gmail.com*

ABSTRACT: *Microplastic (MP) pollution has become a significant environmental concern, particularly in aquatic systems. This study aims to assess the extent of microplastic contamination in groundwater near three major landfill sites in Kerala, South India. Given the reliance on groundwater for drinking and agricultural purposes in this region, understanding the levels of microplastic contamination is crucial for public health and environmental sustainability. The study systematically collected groundwater samples from wells within a 1 km radius of the landfill sites. Sampling was conducted during pre-monsoon and post-monsoon seasons to capture seasonal variations in microplastic concentration. The collected samples were subjected to filtration and peroxide digestion to isolate microplastics. Microplastic polymer types were identified and quantified using Raman spectroscopy and microscopic analysis. The surface morphology of the MP particles was characterized using SEM analysis. The findings revealed a significant presence of microplastics in the groundwater samples across all three sites, varying concentrations between 3 and 92 particles/l in pre-monsoon season and 15 to 110 particles/l in post-monsoon season. Notably, the landfill with a higher waste footprint exhibited a higher microplastic abundance, suggesting a direct relationship between waste volume and microplastic contamination. Polyethylene (PE) and polypropylene (PP) were the most commonly detected polymers, indicating potential sources related to plastic waste decomposition at the landfill sites. Seasonal analysis showed higher concentrations during the post-monsoon season, suggesting surface runoff and groundwater recharge as major pathways for MP pollution in groundwater in study sites. These findings underscore the pressing need for better waste management practices and groundwater protection measures in Kerala. The study provides valuable baseline data for policymakers and environmental agencies to develop targeted strategies to mitigate microplastic pollution in groundwater resources. This research is among the first to document microplastic contamination in groundwater near landfill sites in India at an extensive level, adding to the global understanding of microplastic distribution in terrestrial water systems.*

Keywords*: microplastic, landfill, groundwater, water pollution, waste management.*

Fault diagnosis of Proton Exchange Membrane Fuel Cell Power Systems for Maritime Applications

Vikash Sinha*, Hare Ram Hare
Indian Maritime University, Mumbai Port Campus, Department of Marine Engineering, A Central University, Govt. of India, India
**Corresponding Author: vikashsinha.mpc.ctf@imu.ac.in*

ABSTRACT: *Fuel cell systems as clean power sources are very attractive for the maritime sector. It is committed to sustainability and reducing greenhouse gas emissions and atmospheric pollutant emissions from ships. This paper presents fault diagnosis algorithm on proton exchange membrane fuel cell (PEMFC) system for maritime applications. The available fuels including hydrogen, ammonia, renewable methane and methanol for fuel cells under the context of sustainable maritime transportation and their pre-processing technologies are analyzed. Proton exchange membrane, molten carbonate and solid oxide fuel cell systems are found to be the most promising options for maritime applications. This is due to their energy efficiency, power capacity and sensitivity to fuel impurities. An unknown input observer (UIO) based fault diagnosis technique for marine PEMFC system is presented. The algorithm is derived based on the assumption that fault occurs in a single component at any time instant. First, a number of UIOs are designed for the system in such a way that one particular observer will be sensitive to a particular component and residuals are determined. Then, a fault diagnosis algorithm is formulated based on residuals. The effectiveness of the algorithm is shown with simulation results.*

Keywords*: PEMFC, sustainability, maritime transportation, fault diagnosis, UIO.*

Isolation and Screening of Extremophilic Fungi from Marine Environment for Bioactive Compound Production

Krishna priya Sahu, Narasimha Golla*
Department of Virology, Sri Venkateswara University, Tirupati, A.P, India
**Corresponding Author: dr.g.narasimha@gmail.com*

ABSTRACT: *The marine environment has high biodiversity and promising sources for bioactive compounds. This study aims to isolate and screen marine extremophile fungi for bioactive compound production. Nine fungal cultures were isolated from the coastal mangrove regions of Visakhapatnam and Machilipatnam of Andhra Pradesh, India, and studied the physicochemical and biological properties of mangrove soil like PH, water holding capacity, carbon, phosphorus, manganese, and iron. Further, the isolated fungal cultures were screened for amylase and cellulase activities. The prominent fungal cultures were partially identified based on colony morphology characters including color, size, shape, and texture. Microscopic observation was made to observe conidiospores, sporangium, and spores of fungi. Further studies and characterization are to be made to extract and identify secondary metabolites/bioactive compounds from potent fungal strains and to determine their applications as antimicrobial, anticancer, and antiviral agents.*

Keywords*: Mangrove soil, Marine fungi, physicochemical properties, biological properties, screening.*

Physical Chemical and Biological Properties of Marine Mangrove Soil and their Enzyme Activities

E. Sandhya Rani, Narasimha Golla*
Department of Virology, Sri Venkateswara University, Tirupati, Andhra Pradesh, India
**Corresponding Author: dr.g.narasimha@gmail.com*

ABSTRACT: *Earth's surface comprises 71% water and 29% land, with soil as the critical interface between the lithosphere, hydrosphere, atmosphere, and biosphere. Soil is considered the "skin of the Earth," a complex mixture of organic matter, minerals, liquids, gases, and microorganisms that supports life and influences numerous ecological processes. In coastal ecosystems, such as mangroves, soil quality assessment is essential for understanding environmental health and sustainability. This study emphasizes marine mangrove soil's psychological, chemical, and biological characteristics. The physical properties of soil, include texture, water-holding capacity, porosity, color, permeability, and bulk density. Chemical properties such as pH, electrical conductivity, and the concentration of organic matter macro and micronutrients are Carbon, Potash, Zinc, Manganese, Phosphorus, Iron, and Copper vital for determining soil fertility. Biological properties, including microbial communities like actinomycetes, fungi, and algae, are crucial in nutrient cycling and organic matter decomposition. Actinomycetes, in particular, are important for the degradation of marine waste and the production of enzymes essential for ecosystem functioning. Their isolation from mangrove soils involves biochemical tests, including starch hydrolysis, gelatine liquefaction, casein hydrolysis, hydrogen sulfide (H_2S) production, and sugar fermentation, which help assess their metabolic capabilities. Understanding these properties of mangrove soils is vital for effective ecosystem management and protect coastal environments.*

Keywords*: Soil, Actinomycetes, Organic matter, degradation of marine waste, ecosystem.*

XI.
Model

A Secure and Efficient Key Management for Intrusion Detection in Cloud Storage based on PLS and SVM Model

Suresh Kumar[1,*], S. Rajathi[2], Vineetha Vargheese[2], Anju A Sanu[3], Punitha P.[4], T Udhayakumar[5]

[1]Dept. of CSE Rathinam Technical Campus Coimbatore, India

[2]Dept. of Computer Science and Engineering, Rathinam Technical Campus, Coimbatore, T.N, India

[3]Dept. of Electronics and Communication Engineering, Rathinam Technical Campus, Coimbatore, T.N, India

[4]Dept. of Information Technology, Nirmala College for Women, Coimbatore, India

[5]Dept. of CSE Hindustan Institute of Technology, Campus Coimbatore, India

**Corresponding Author: suresh.aacet@gmail.com*

ABSTRACT: *Cloud computing, a novel way of storing and processing data, has become an essential tool for many individuals very soon. With the proliferation of AI and big data, it is now standard practice in manufacturing to employ these technologies to discover novel approaches to enhancing decision-making or to accelerate production. This proposed method consists of three phases: preprocessing, feature extraction, and model training. In order to make the text data more suitable for further analysis or modeling, text preprocessing aims to improve its quality and usefulness. Information gain (IG), symmetric uncertainty, gain ratio, chi- squared, and other filter-based feature selection approaches are employed for feature selection. We used a PLS-SVM to train the model. The proposed methodology outshines more traditional methods. After using the strategy, the accuracy was enhanced by 95.43%.*

Keywords*: Intrusion Detection System, Cloud Computing, Partial Least Square Model (PLS).*

Deep Dive into Mobile Edge Computing: Unraveling Collaborative High-Speed Inference with Topological Insights

Vineetha Varghese[1,*], Rajathi S[2], V. Arulmozhi[3], Anju A Sanu[4], Suresh Kumar A[5]

[1,2,5]Dept. of Computer Science and Engineering, Rathinam Technical Campus, Coimbatore, India

[3]Dept. of Artificial Intelligence and Data Science, Rathinam Technical Campus, Coimbatore, India

[4]Dept. of Electronics and Communication Engineering, Rathinam Technical Campus, Coimbatore, India

**Corresponding Author: faithvineetha@gmail.com*

ABSTRACT: *The importance of edge computing is demonstrated by how well it works with sensor data and information extraction. An essential component of intelligent systems, deep learning has resource constraints. A solution is provided by strategically positioned Distributed Deep Neural Networks (HSITI) in fog, devices and clouds. They leverage shallow layers to enhance cloud-based DNN interpretation, enabling quick and accurate edge and end device analysis. Global expansion is facilitated by HSITI's scalability, which is anchored in cloud architecture. The research suggests improvements in item detection and lower communication over head that are driven by sensors. Rapid convergence and accuracy are guaranteed when Stochastic Gradient Descanted collaborative learning is used. The paper highlights how HSITI may transform edge computing and provides practical uses for improved sensor- based object detection.*

Keywords*: Neural Network Architecture, Swift, Cloud Integration, Artificial Intelligence.*

The Implementation of Deep Learning Techniques in Advance Image Reorganization Capabilities

Shruti Thapar*, Ashima Tiwari, Aditi Agarwal

Computer Science and Engineering, Poornima Institute of Engineering Technology, Jaipur, Rajasthan, India

**Corresponding Author: shruti.thapar@poornima.org*

ABSTRACT: *This paper constitutes a survey of deep learning technologies applications in image recognition. A vast subset of machine learning, deep learning has shown tremendous abilities of interpreting visual data and is changing the sphere of human activities in many industries such as healthcare, security, and automated driving. It constitutes a family of deep neural networks, including Convolution Neural Networks (CNNs), which are extremely successful in producing exceptional performance in activities such as object detection, facial recognition, and image classification tasks. This article surveys the principles associated with deep learning for image recognition, publishes recent developments and breakthroughs, and gives examples of practical applications. By analyzing and comparing with traditional image processing techniques, the authors highlight the high efficiency and accuracy of deep learning models. Also, challenges and limitations are focused on within this fast-growing field to lead inquiries into future research directions. The result explores the development of this field and corroborates that deep learning in image recognition is fast growing in its spotlight to leverage the computational prowess by changing how visual data is interpreted by machines in an ever-more digitized world.*

Keywords*: Deep Learning, Image Reorganization, CNN, Neural Networks, Machine learning.*

Optimization of Extrusion Process for Modulating the Physical and Hydration Properties of Broken Rice Flour using Artificial Neural Network and Genetic Algorithm

Bobade Hanuman[1,*], Prabhjeet Kaur[1], Savita Sharma[1], Baljit Singh[1], Akshay Sonawane[2]

[1]Department of Food Science and Technology, Punjab Agricultural University, Ludhiana, India

[2]Leibniz-Institute for Agricultural Engineering & Bioeconomy (ATB), Potsdam, Germany

**Corresponding Author: hanuchk@pau.edu*

ABSTRACT: *This research aims to modulate the selected physical and hydration properties of broken rice flour through extrusion processing and optimize process variables using artificial neural networks and genetic algorithms. The broken rice flour was extrusion processed using a twin-screw corotating extruder at different conditions of processing variables, feed moisture (14-18%), extrusion temperature (120-160°C), and screw speed (300-450 rpm). The experiments were planned according to a central composite rotatable design at five levels of input variables. Optimization was performed using an artificial neural network (ANN) and genetic algorithm (GA). The model development and validation were performed based on coefficient of determination (R2) and lack-of-fit test. The results of the study revealed that significant modulation occurred in the physical and hydration properties of broken rice flour as a function of extrusion process parameters. The extrusion temperature and screw speed caused a reduction in bulk density, water absorption, wettability, and oil absorption. These process parameters increased water solubility, dispersibility, Hausner ratio, and Carr index. The ANN-GA optimized values of the process variables constituted 14.47% feed moisture, 156.40°C extrusion temperature, and 423 rpm screw speed. The findings of this study would help in the utilization of broken rice in the development of efficient quality products requiring rehydration properties.*

Keywords*: broken rice, hydration properties, extrusion, optimization, artificial neural network.*

Modelling the Effect of Ceramic Membranes Production Variables on their Physical Properties

Kareem H. Hamad[1,*], Sh. K. Amin[2]

[1]Egyptian Academy for Engineering and Advanced Technology (EA&EAT) Affiliated to Ministry of Military Production, Cairo, Egypt
[2]Chemical Engineering and Pilot Plant Department, Engineering and Renewable Energy Research Institute, National Research Centre (NRC), Dokki, Giza, Egypt
**Corresponding Author: k.hossam@eaeat-academy.edu.eg*

ABSTRACT: *The pillars of sustainability are water, food, and energy; thus, water treatment is one of the most important topics nowadays. Membrane separation is one of the leading techniques used in watertreatment due to its merits, ceramic membranes attract most of the researchers as ceramic membranes surpass polymeric membranes in their properties. In this research modelling andoptimization of fabrication conditions takes place to produce a low cost yet highly efficient membrane. Response surface methodology (Box Behnken) was used to model the influence of two production variables namely the curing temperature and curing time, in addition to the assessment of zeolite addition percent, on the membrane physical properties such as cold-water absorption, saturation coefficient, bulk density, porosity and strength. All the produced models fit the experimental data with 95% confidence level, it was found that curing temperature, and zeolite percent have significant direct proportional effect on bulk density and mechanical strength, on the other hand they are inversely proportion to CWA and porosity. Optimization of production variables revealed that using 20% zeolite at sintering temperature of 1200oC for 30 minutes produces the best membrane that has around 40% porosity, 36 MPa compressive strength, 1.34 bulk density, 85% saturation coefficient and 25% CWA.*

Keywords*: Wastewater treatment; Ceramic membranes; Statistical modeling.*

Supplier Selection in Supply Chain Management Using Intuitionistic Trapezoidal Fuzzy Numbers, Earth Mover's Distance and Fuzzy TOPSIS

G. Padma[1,*], K. Srinivasa Rao[2], N. Ravi Shankar[1]

[1]Dept. of Mathematics, GSS, GITAM (Deemed to be University), Visakhapatnam, India
[2]Dept. of Operations, GSB, GITAM (Deemed to be University), Visakhapatnam, India
**Corresponding Author: pganta@gitam.in*

ABSTRACT: *Supplier selection is a critical decision-making process in supply chain management, significantly impacting operational efficiency and cost-effectiveness. Traditional methods often struggle to handle the inherent uncertainty and vagueness involved in evaluating supplier criteria. This paper proposes a novel approach for supplier selection using Intuitionistic Trapezoidal Fuzzy Numbers (ITFNs), combined with Earth Mover's Distance (EMD) and Fuzzy Technique for Order Preference by Similarity to Ideal Solution (Fuzzy TOPSIS), to effectively model and address these uncertainties. ITFNs allow for the representation of both membership and non-membership degrees, enhancing the ability to capture imprecision in supplier evaluations. The Earth Mover's Distance, a powerful metric from transportation theory, is employed to rank the intuitionistic trapezoidal fuzzy numbers and compare suppliers based on multiple criteria using fuzzy TOPSIS. The proposed model is demonstrated through a case study, showcasing its ability to provide more flexible and accurate supplier rankings compared to conventional methods. This approach offers valuable insights for decision-makers aiming to optimize supplier selection in complex and uncertain environments, contributing to more resilient supply chains.*

Keywords*: Supplier selection; Supply Chain Management; Transportation problem; Earth Mover's Distance; Decision making; Intuitionistic Trapezoidal Fuzzy Number.*

Causes and Defect Identification in Diaphragm Wall Construction: A Systematic Approach

M. Harinath*, A. Hemamalinie, B. Vijaya, A. Santhosh
Dr. M.G.R. Educational & Research Institute, Chennai, India
**Corresponding Author: mharinatheng@gmail.com*

ABSTRACT: *Diaphragm walls are critical structure in modern construction world, used extensively for supporting deep excavations and retaining structures. Their integrity is paramount for ensuring the stability and safety of various construction projects. Despite their significance, diaphragm walls are prone to a range of defects that can compromise their performance and lead to severe safety and financial repercussions if not detected and addressed promptly. Traditional defect detection methods often rely on manual inspections and subjective assessments, which can be inconsistent and prone to errors. This project aims to develop a systematic approach for defect identification and causes in diaphragm wall construction. The primary objectives include creating standardized criteria for defect detection, utilizing advanced technologies such as digital imaging and machine learning for accurate identification, and establishing a framework for classifying the severity of defects. By integrating these elements, the project seeks to enhance the accuracy of defect detection, improve safety, reduce costs associated with repairs, and optimize overall project management. The proposed systematic approach promises to offer a more reliable, efficient, and objective method for managing defects in diaphragm walls, thereby contributing to the successful execution of construction projects.*

Keywords*: Diaphragm Wall, traditional inspection, tremie concrete, verticality check.*

Exploring innovative business models for waste management and recycling through cutting-edge technologies: A comprehensive literature review

Prasanna Kumar C S*, Saisree Mangu
GITAM, School of Business, Bengaluru, India
**Corresponding Author: psuryapr@gitam.in*

ABSTRACT: *This comprehensive literature review aims to explore innovative business models that integrate cutting-edge technologies to optimize waste management and recycling practices. By synthesizing existing research, this study identifies opportunities for value creation, cost reduction, and environmental sustainability through the adoption of digital twins, Internet of Things (IoT), Artificial Intelligence (AI), and Block chain technologies in waste management. The review highlights the potential of circular economy-inspired business models, such as product-as-a-service, sharing economy, and pay-per-use, to promote waste reduction, recycling, and up cycling. By analysing diverse business models that leverage these technologies, the paper identifies key trends, challenges, and opportunities within the sector. The findings highlight the potential for these innovations to enhance resource recovery, reduce environmental impact, and promote sustainable practices. Furthermore, it examines the role of data analytics, smart sensors, and robotics in enhancing waste sorting, processing, and disposal efficiency. This study provides a road-map for policymakers, entrepreneurs, researchers and industry stakeholders aiming to address the complexities of modern waste management through sustainable, technology-enabled approaches and to implement innovative business models that harness the power of technology to transform the waste management sector, ultimately contributing to a more sustainable and environmentally conscious future and foster a circular economy, underscoring the necessity for continued innovation and collaboration among stakeholders. The global waste management crisis necessitates a paradigm shift towards sustainable and technologically-driven solutions.*

Keywords*: waste management, innovative business models, cutting-edge technologies, circular economy, sustainability.*

Endophytic Fungi from Swietenia Mahogany and Media Optimization for Didymella Glomerata (MH458895) using Fuzzy Logic System – First Report

Priyadharshini Ramesh[1,*], Senthamarai Manogaran*[2], Kamalanathan Chandran[2], and Kannan Kilavan Packiamd[1]

[1]Bio Molecular Characterization and Instrumentation Laboratory, Centre for Research and Development, Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India.
[2]Department of Microbiology, Food Science and Technology, School of Life sciences, GITAM Deemed to be University, Bengaluru, Karnataka.
.*Corresponding Author: smanohar@gitam.edu*

ABSTRACT: *This research study was performed to investigate the tree, Swietenia mahogany (L.) Jacq. collected from the garden of Bannari Amman Institute of Technology, Erode District, Tamil Nadu for the biodiversity of Endophytic fungi and its cellulase-producing potential. The fruit part of the tree was chosen to isolate the endophytic fungi after performing surface sterilization. Four endophytic fungi were isolated from the fruit tissue of the plant and it was investigated based on microscopic and morphological characteristics. Among them, less explored, uncommon endophytic fungi Didymella glomerata (MH458895) were selected for this research study. Molecular evolution studies with Phylogenetic relationships confirmed the endophytic fungi as Didymella glomerata (MH458895). The growth profile of this novel isolate was intensively studied in the four distinct, cost-effective nutritive media M1, M2, M3, and M4 with natural components in the conical flasks based on the nutritional requirements of the isolate. Among the four media, M3 was chosen due to the maximum growth of the isolate, confirmed by UV and optimized further using the Fuzzy Logic system [FLS] with MATLAB Software Version 7.3. Reformulation of the M3 media was done for maximum growth and metabolites production in the fermenter under controlled conditions as per the combinations predicted by the FLS. After 6 days, the fermented broth of the reformulated M3 media was centrifuged and the biomass was determined. Finally both the supernatant and pellet after sonication were analysed for volatile metabolites by GCMS.*

Keywords*: Endophytic fungi, Morphological analysis, Phylogenetic relationship, Growth profile, Biomass estimation, FLS-MATLAB Version 7.3 and GCMS.*

Optimizing Fuzzy Transportation Models: A Generalized Intuitionistic Trapezoidal Fuzzy Number-Based Approach

K. Yogesh Naidu, N. Ravi Shankar

Dept. of Mathematics, GSS, GITAM (Deemed to be University), Visakhapatnam, India
**Corresponding Author: ykonapar@gitam.in*

ABSTRACT: *In this study, an innovative approach is proposed to solve fuzzy transportation problems using Generalized Intuitionistic Trapezoidal Fuzzy Numbers (GITFNs). The proposed method effectively handles uncertainty and imprecision in transportation costs, supply, and demand. By selecting a suitable ranking function, the fuzzy transportation problem is converted into crisp one, which is easily solved by the standard transportation algorithms. The approach is tested on numerical examples, demonstrating improved accuracy and strength compared to existing fuzzy transportation methods. The results indicate that the proposed approach can effectively optimize fuzzy transportation solutions, providing valuable insights for logistics and supply chain management.*

Keywords*: Fuzzy Transportation Problem, Generalized Intuitionistic Trapezoidal Fuzzy Numbers, Defuzzification, Supply Chain Management, Logistics Optimization*

XII.
Nano Science and Technology

Facile One-pot Microwave-Assisted Synthesis of Nitrogen-Doped Carbon Nanoparticles using β-alanine and polyvinyl pyrrolidine, Metal Ion Detection

Yeduru Venkatesh[1,2], P Venkata Subrahmanyam Naidu[1,*]

[1]Department of Chemistry, GITAM University, Visakhapatnam, Andhra Pradesh, India
[2]Department of Chemistry, Dr. VS Krishna GDC(A), Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: pparimi@gitam.edu*

ABSTRACT: *Heavy metal contamination in water is a significant environmental concern due to its harmful effects on aquatic life and human health, as these metals can accumulate in the food chain. Monitoring heavy metal concentrations in water is therefore crucial. Fluorescent carbon nanoparticles (CNPs) are promising materials for this purpose due to their small size (<100 nm) and high solubility in aqueous solutions. This study aims to develop a simple, cost-effective, and environmentally friendly bottom-up approach for synthesizing nitrogen-doped carbon nanoparticles (N-CNPs) using microwave radiation. The synthesis involves a one-pot method with β-alanine (BA) and polyvinyl pyrrolidone (PVP) as precursors. The resulting N-CNPs exhibit strong fluorescence and high water solubility, though the hygroscopic nature of the CNP powders causes them to adhere to vial walls during long-term storage. The morphology and particle size distribution of the synthesized N-CNPs were analyzed using high-resolution transmission electron microscopy (HRTEM) and field-emission scanning electron microscopy (FE-SEM). The TEM images revealed that the N-CNPs are spherical with an average size of approximately 21.79 nm, though they tend to agglomerate due to surface tension during the drying process. The X-ray diffraction (XRD) analysis confirmed, a strong peak (002) centred around 22.5o, the presence of an amorphous carbon phase, consistent with the HRTEM findings. The diffused rings formed are also confirmed the amorphous phase by Selected area electron diffraction (SAED). In addition to that elemental analysis via energy-dispersive X-ray spectroscopy (EDX) indicated the presence of carbon (65.74 wt.%), nitrogen (15.01 wt.%), and oxygen (19.26 wt.%). Fourier-transform infrared (FTIR) spectroscopy further revealed the surface functional groups, including -OH, -NH, C=O, and C=N bonds, contributing to the chemical structure of the N-CNPs. The produced NCPs exhibit two typical absorption peaks at 225 and 325 nm. The absorption peak at 225 nm corresponds to the π−π* transition of aromatic −C=C− bonds in the sp2-hybridized domain of the graphitic core, whereas the peak at 325 nm corresponds to the n−π* transition of −C=O or C=N groups on the surface of NCPs. These findings suggest that the synthesized N-CNPs have potential for environmental monitoring and heavy metal detection applications.*

Keywords*: Microwave-assisted Synthesis, Characterization-SEM, HRTEM, XRD, EDX, SAED, FTIR, UV-VISIBLE, and Metal ion detection.*

Selective nanoencapsulation of quercetin from sprouted onion crude extract in reassembled chitosan particles

Ishrat Majid*, Basharat Dar

Islamic University of Science & Technology, Awantipora, Pulwama (Kashmir), India
**Corresponding Author: ishratmajid89@gmail.com*

ABSTRACT: *The present study evaluated the efficiency of multiple extraction techniques to recover quercetin from sprouted onions. The ultrasound-assisted extraction among the three techniques viz, conventional solvent extraction, microwave-assisted extraction and ultrasound extraction resulted in remarkable extract recovery and produced the crude extract with a maximum quercetin content of 27.87 mg/g of the extract. Quercetin from aqueous crude extract of sprouted onions were encapsulated with chitosan particles to enhance its bioavailability and water solubility for food and pharmaceutical formulations. A maximum encapsulation yield of 97% was obtained for the reassembled chitosan particles. Characterization of the nanoencapsulated powders through scanning electron microscopy unveiled their distinctive irregular morphology. Fourier-transform infrared (FTIR) analysis furnished compelling evidence of successful encapsulation, presenting the quercetin in an amorphous state. Notably, the DSC analysis depicted the thermal stability of the encapsulated sample which affirms the innovative nature of our approach. Significantly, the encapsulated quercetin retained the particular absorption bands of the sprouted onion extract, underscoring the retention of its characteristic chemical composition throughout the encapsulation process.*

Keywords*: Onion; Sprouts; Quercetin; nanoencapsulation; FTIR.*

Green Synthesis, Characterization, and Antimicrobial Activities of Copper Nanoparticles from the Moringa Oleifera Leaf Extract

Gajarmal Komal M.[1,*], Patil Neha N[2], Walhe Rajan A[3]

[1]Dept. of Microbiology, PDEA'S Waghire College Saswad, Pune, India,
[2]Dept. of Microbiology, Professor, PDEA'S Annasaheb Magar Mahavidyalaya, Hadapsar, Pune, India
[3]Dept. of Microbiology, Professor Abasaheb Garware College, Karve Road, Pune, India

**Corresponding Author: komal.gajarmal7@gmail.com*

ABSTRACT: *The green synthesis of nanoparticles is a remarkable over the conventional physical and chemical methods. It is an eco-friendly, compatible, nontoxic and clean method compared to the toxic, noncompatible conventional method. Nanoparticles have an immense application in various fields. As compared to bulk compound, nanoparticles have more active sites due to their large surface to volume ratio. Nanotechnology opens a new dimension to search and develop sustainable sources of drugs. Despite the presence of potent antimicrobial compounds, continuous emergence of multidrug resistance in bacteria is appearing. Therefore, there is need to search for sustainable sources of drugs effective against pathogen. The present study deals with the synthesis of copper nanoparticles using Moringa oleifera leaf extract and its antimicrobial activities against human pathogen. The bioactive constituent of M. oleifera leaves causes the reduction of copper metal to its nanoparticle. The characterization of the produced nanoparticles was done by UV visible spectroscopy, scanning electron microscopy (SEM), Fourier infrared spectroscopy (FTIR), X-ray diffraction (XRD), and energy-dispersive X-ray analysis (EDX). The reaction mixture turned dark brownish black after 3 hours at 600C and exhibited strong absorbance peak at 340 nm characteristic of copper nanoparticle. The SEM and EDX analysis showed the nanoparticles contain 63.87% of carbon, 31.80% of oxygen, and 4.31% of sulfur and the size were ranging from 21.8 nm to 72.7 nm. FTIR studies revealed that nanoparticles were capped with plant functional group. The antimicrobial study of green synthesized nanoparticles showed significant inhibitory activity against bacterial spp. Such as Staphylococcus aureus (ATCC- 29213), Escherichia coli (ATCC- 4157), Pseudomonas aeogenosa, Klebsiella pneumoniae (MCC-4420),and fungal species viz Candida albicans and Aspergillus niger. Thus, the present study reveals that green synthesis of copper nanoparticles using Moringa oleifera leaf extract has potential against important microbial pathogens.*

Keywords*: Moringa oleifera, Nanoparticle, Antimicrobial, copper Nanoparticle.*

Experimental Investigation on reactive nano Zero valent Iron (nZVI) loaded bio char for removal of chromium from aqueous solution: Batch and Column Studies

Pruthvi B N*, Prathima B, Krishnamurthy Sainath

B.M.S College of Engineering, Bengaluru, India

**Corresponding Author: pruthvi.cee22@bmsce.ac.in*

ABSTRACT: *Hexavalent chromium contaminates water in the environment, endangering both human populations and ecosystems. Sewage sludge is a by-product of wastewater treatment procedures. Utilizing sewage sludge to produce bio char can help to reduce the volume of waste generated by wastewater treatment plants and provide a more sustainable approach to managing sewage sludge. In this study, to remediate wastewater containing Cr (VI), sewage sludge bio char was produced by using municipal sludge as the raw material and combining it with reactive nano zero-valent iron. Biochar material was produced from sewage sludge through the reaction process carried out for 2 hours at 550 °C in muffle furnace and subsequently loaded with nZVI. Batch experiments were conducted to evaluate the removal efficiency of Cr (VI). The effects of pH, contact time, dosage and initial Cr concentration on removal efficiency were examined. The nZVI biochar was characterized using EDX energy spectrum exhibited stronger Fe peaks, and the Fe content increased from the previous 26.8% to 42.5% and FTIR analysis showed that functional groups determined were mainly oxygen containing functional groups and the stretching vibration of Fe-O and Fe-OH on bio char was stronger, proclaiming that iron oxide films were produced at the surface of nZVI during loading. The results showed that nZVI-loaded biochar achieved to be 76% to 83% removal of Cr (VI) at both acidic and alkaline at 300mg/L with a contact time of 4hrs and marginal decrease in adsorption capacity of nZVI loaded biochar is recorded with increase in pH. The Cr (VI) removal process could be fitted by the Langmuir isotherm and pseudo-First-order kinetic model. Characterization techniques revealed the successful loading of nZVI onto the bio char surface. The study demonstrated that the nZVI loaded bio char will be an effective material in mitigation of Cr (VI) contamination in water*

Keywords*: Adsorption; nano-zero-valent-iron; Hexavalent Chromium; sewage sludge bio char.*

Experimental Investigation on Nano Material based Concrete with Human Hair as Fibre

S. Karthikeyan[1,*], P. Vasanthi[1], B.Vijaya[2], Priyanka[1], R.Swathi Rekha[1]

[1]Dept. of Civil Engineering, Chennai Institute of Technology, Kundrathur, Chennai, India
[2]Dept. of Civil Engineering Dr. M.G.R. Educational and Research Institute Chennai, India

**Corresponding Author:*

ABSTRACT: *Traditional Concrete and its alternatives have been studied for possible replacements in innovative and sustainable building materials, this study presents an investigation of human hair used as a reinforcement fiber in the concrete mix, supplemented with Nano materials. Human hair possesses mechanical properties that make it a potential candidate for enhancing the performance of concrete. The research focuses on assessing the Mechanical properties, like compressive strength, flexural strength, and durability of concrete specimens containing varying proportions of hair fibers. Additionally, the incorporation of Nano materials aims to further enhance the mentioned properties of the concrete. The results indicate that the introduction of human hair fibers into the concrete mix improves the flexural strength and ductility, while the Nano materials contribute to increased compressive strength and durability. This study brings valuable insights into the utilization of human hair fibres in combination with Nano materials to develop a high-performance concrete, with many potential applications in Infrastructure Development. The construction industry constantly seeks sustainable and innovative solutions to enhance the performance and longevity of concrete. Human hair, readily available as a waste product, possesses unique mechanical properties that make it a promising candidate for improving concrete performance. The research focuses on comprehensively evaluating the mechanical properties, including compressive strength, flexural strength, and durability aspects of concrete specimens incorporating varying proportions of human hair fibers.*

Keywords*: Nano Materials, Human hair, compressive strength, flexural strength.*

Green synthesis of silver nanoparticles using methanolic extracts of Ulva lactuca

S.B. Sainath[1,2,*], B. Kishori[2], MV Mrunalini[2], P. N. Deepthi[2]

[1]V.S. University, Nellore-524324, AP, India
[2]Department of Biotechnology, SPMVV, AP, India

**Corresponding Author: drsainath@vsu.ac.in*

ABSTRACT: *The role of green chemistry principles in the synthesis of metal nanoparticles using plant-based extracts is one of the most efficient, economical, and eco-friendly methods to overcome the involvement of toxic chemicals. Prior synthesis of nanoparticles, we determined the phytochemical analysis and identification of bioactive principle (methonolic extract) from U.lactuca. In this study, we employed green chemistry approaches to synthesis silver nanoparticles (AgNPs) using an alga, Ulva lactuca L to investigate the role of biomolecules in algae in the formation of AgNPs from cationic silver under different physicochemical conditions such as pH, temperature, reaction time and reactants concentration. The characterization of synthesized nanoparticles was determined using spectroscopy, FT-IR, EDAX and dynamic light scattering and zeta potential. AgNPs were also analyzed with various applications such as antimicrobial, antifungal and antioxidant activities. Results revealed that the synthesized NPs have potential antibacterial activity against to Staphylococcus aureus, Bacillus subtilis, Escherichia coli and Pseudomonas aeruginosa with no antifungal activity. Green synthesis of U. lactuca NPs exhibited antioxidant activities in vitro. The results will be discussed in the light of literature.*

Keywords*: Antibacterial activity, antioxidants, green synthesis, nanoparticles, Ulva lactuca.*

Harnessing Nanotechnology: Biosynthesis and Characterization of Silver Nanoparticles and their Biomedical and Environmental Advancements

Narasimha Golla*

Department of Virology, Sri Venkateswara University, Tirupati, A.P. India
**Corresponding Author: dr.g.narasimha@gmail.com*

ABSTRACT: *Nanotechnology is a novel interdisciplinary science serving as a nexus between the basic sciences spelling its charm in many fields of science and life sciences are no exception. As the multi-drug resistance in pathogens has made antibiotics inefficient, nanoparticles are the next lookout. Silver nanoparticles have been found to have applications in various fields such as inter-chelating agents. Due to their enhanced responsiveness to environmentally friendly technology for quantifiable synthesis, several developed nations have seen significant growth in the biosynthesis of Ag NPs. The biological method, however, is the approach to preparation that is most in demand since it is quicker, safer, less expensive, and more environmentally friendly than other techniques. In addition, the importance of Ag NPs is extensively examined in light of their numerous applications, including those for antifungal, anti-inflammatory, antibacterial, Antiviral, and bio-catalytic activity, and anticancer medicines. materials for electrical batteries, optical receptors, catalysis in chemical reactions, biolabeling agents, sensors bioactive materials, and antimicrobial agents in the biomedical fields. The significant texture of silver is its broad-spectrum antimicrobial property due to microbial colonization associated with biomaterial-related infection. Recent reports indicate that fungi, Viruses, and bacteria are susceptible to silver nanoparticles. Biological synthesis of nanoparticles with silver occupying the top slot, in our lab metallic silver nanoparticles (BioAgNPs) were synthesized by an ecofriendly approach by reacting the silver nitrate (AgN03) with cell-free filtrate of various microbial sources. viz fungi (Aspergillus niger, Aspergillus flavas, and Agaricus bisphoris) Actinobacteria (Actinomycetes), and the plant parts (leaves, flowers, stems, etc). Using plant sources as reducing agents in forming AgNPs is most attractive due to the cost-effective and time-consuming process for AgNP synthesis. In our studies various plants, Piper bettle, Ocimum leaves Azadirita indica, Ficus religiosa, and Zuzuphus are used for AgNP synthesis. The synthesized AgNPs were characterized by UV-visible spectroscopy, FTIR, SEM, and DLS analysis to further examine their efficacious biosynthesis and morphological properties including size, shape, and stability. The probable mechanism for the extracellular biosynthesis of silver nanoparticles was explained. The synthesized silver nanoparticles exhibited medical applications like antibacterial (Gram-positive and Gram-negative) and antifungal (Aspergillus niger,) and biocatalytic properties on decolorization of natural and textile dyes which is environmental cleanup.*

Keywords*:*

Sodium Alginate-Essential Oil Nanoemulsion: A Sustainable Food Preservation Coating

Sudipta Kumar Das, Sandhimita Mondal*

Department of Biotechnology, Brainware University, 398 Ramkrishnapur Road, Barasat, North 24 Pgs, Kolkata, West Bengal, India

**Corresponding Author: sandhimita@gmail.com*

ABSTRACT: *This study presents a new nanoemulsion-based coating (NE) made from sodium alginate and apricot oil, designed to improve food safety and quality by inhibiting foodborne pathogens and preventing biofilm formation on fresh produce. Biofilms are a major cause of contamination and spoilage, making food preservation challenging. Characterized by Dynamic Light Scattering (DLS), Fourier-Transform Infrared Spectroscopy (FTIR), and UVVisible (UV-Vis) spectroscopy, the NE nanoemulsion displayed stability, high transparency, and a neutral pH of 7.0, allowing for safe use across different foods without impacting taste. Its antibacterial and antibiofilm effectiveness was assessed against Escherichia coli (EC), showing notable decreases in bacterial growth, surface adherence, and biofilm formation. When applied to tomatoes, the NE coating extended shelf life by minimizing weight loss and softening over a two-week storage period, preserving freshness and visual appeal. NE represents a non-toxic, biocompatible, and cost-effective alternative to chemical preservatives, offering a sustainable approach to food preservation that enhances both safety and quality while reducing dependence on synthetic additives, supporting environmentally responsible postharvest treatment methods..*

Keywords*:*

XIII.
New Devlopment

Beyond Traditional Concrete: The Rise of Bio-Concrete

Alefiya Idris Kachwala[1,*], Piyushkumar J. Patel[2]
[1]Ganpat University, Mehsana, India
[2]Sakalchand Patel College of Engineering, Visnagar, India
**Corresponding Author: aikachwala@bbit.ac.in*

ABSTRACT: *Choosing the right building materials is essential for designing structures that support sustainable development. Concrete, a staple in construction, has a significant environmental impact due to its high energy requirements during production. Moreover, concrete is prone to cracking from external factors. To achieve durability and sustainability, it's crucial to employ environmentally friendly and effective crack repair methods. Bacterial self-healing concrete presents a promising alternative, reducing inspection and maintenance costs, and ultimately extending the lifespan of structures. However, despite its potential benefits for durability, bacterial concrete is not yet widely adopted in the industry; primarily due to the high initial costs associated with the materials and process as well the research in marine construction has still to be explored. This paper investigates the opportunities for bacterial self-healing concrete in emerging construction sectors.*

Keywords*: Bacteria, sustainable construction, crack repair, calcium carbonate, marine.*

Machine Learning-Enhanced Model-Based Leak Detection in Pipe Networks

Manish Kumar Mishra[*], Ankita Chandola, Rashi Badiya
Dayananda Sagar University, India
**Corresponding Author: manish-me@dsu.edu.in*

ABSTRACT: *Leak detection in pipe networks is crucial for effective water management. This paper presents a model-based leak detection strategy that incorporates machine learning (ML) techniques with EPANET for hydraulic modeling. EPANET simulates normal operating circumstances in the water distribution system, giving baseline hydraulic parameters like pressure, flow rates, and node demands. Any variations from the baseline produced by leaks are detected using a mix of hydraulic data and machine learning algorithms based on previous data. The ML model is used to identify potential leak sites based on pressure and flow abnormalities. This hybrid strategy improves detection accuracy by combining physical models with data-driven strategies. The findings indicate enhanced leak localization and lower false positive rates, which contribute to more effective network management and resource conservation.*

Keywords*:*

Integrated Wind Turbine System for Electric Vehicles

V. Bindu Neeharika, Katakam Satyanarayana*, A.K. Viswanadth, Saragada Kanaka Raju

Department of Mechanical Engg. Affiliated to Andhra University, A.P, India

**Corresponding Author: ksnarayana.me@anits.edu.in*

ABSTRACT: *The project aims to design a wind turbine that generates electricity for electric vehicles using wind energy created by the vehicle's motion, addressing the limited energy storage capacity of electric vehicles and reducing reliance on fossil fuels, which are a major source of environmental pollution, by utilizing wind energy through horizontal or vertical wind turbines to power electric vehicles, thereby developing electric vehicles capable of self-generating electricity and promoting a cleaner and more sustainable transportation solution..*

Keywords*: Renewable Energy - Wind Energy, Wind Turbine, Electric Vehicles*

Development of Sustainable Concrete Composite using Metakaolin: An Experimental Analysis

Monika Das*, Sradha Samantara

Department of Civil Engineering, Vignan Institute of Technology and Management, Berhampur, Odisha, India

**Corresponding Author: monikadas13@gmail.com*

ABSTRACT: *Purpose: From different studies, it is observed that cement production is increasing rapidly due to high demand in construction field. In the manufacturing process of cement, carbon dioxide is released into the atmosphere. Research works are going on to find out an alternate way to reduce production of cement. One of the solutions is the use of metakaolin. The purpose of this study is to find out the optimum value of Metakaolin (M.K.) that can be replaced with cement without changing the original properties of conventional concrete.*

Design/methodology/approach: The experimental study on the mechanical and physical properties of conventional and M.K. concrete is reported in this paper. M.K. replaces cement in the total binding material weight by approximately 3%, 6%, 9%, and 12%. At the age of 7 days and 28 days, the compressive strength and flexural strength were determined by partially replacing cement with M.K.

Findings: It was discovered that replacing M.K. up to 9% with cement in concrete can increase its mechanical and physical properties and after 7 days of curing, the compressive strength value decreases.

Implications: The findings of the study enhances the body of knowledge in the area of concrete design that would help the researchers and practitioners. Cement can be partially replaced by Metakaolin without negatively impacting the strength of concrete. As a result, the environment degradation caused by use of cement can be reduced.

Originality/value: Several studies have been conducted on M40 and M50 grade but a few studies were conducted on M30. Replacing cement by Metakaolin in M30 grade concrete is also one of the novelty which is rarely explored.

Keywords*: Concrete, CO_2 reduction, Metakaolin, Compressive strength, Flexural strength.*

Sustainable Encapsulation Calotropis Gigantea Leaf Extracts with Terminalia Chebula for Topical Wound Dressing Cotton Fabric

Ru Yogita Agrawal*, V.R Sampath Shweta Agrawal
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India
**Corresponding Author: yogitaagrawal@svvv.edu.in*

ABSTRACT: *Calotropis gigantea (C. gigantea) crude extract was investigated for its antibacterial efficacy against two pathogenic bacterial species: Escherichia coli and Staphylococcus aureus. Mueller Hinton agar was used for the disc diffusion method of in vitro antimicrobial testing for microorganisms. In this study, cloth that had been prepared with terminalia chebula was treated with an extract from C. gigantea at varying dosages (ranging from 12.5-200 µg/mg of fabric weight). For S. aureus, 25 µg/mg of fabric weight showed a considerably strong inhibitory impact of 107%, whereas E. coli exhibited a very little effect of 13%. Fourier Transform Infrared (FT-IR) spectroscopic analysis of the leaf powder demonstrated the presence of the primary functional groups in the sample. In an in vitro test, the cytotoxicity assessment of cotton wound dressing material revealed 87% cell viability and 13% cell toxicity.*

Keywords*: Antimicrobial activity, Terminalia chebula, Wound dressing Material.*

Utilization of Rice Stubble as a Sustainable Reinforcement in FRP Composites: Mechanical Properties and Environmental Impact

Md. Touseef Ahamad[1,*], Khaleel Abdul Hur Ali[2]
[1]Department of Mechanical Engineering, Acharya Nagarjuna University College of Engineering & Technology, Acharya Nagarjuna University, Guntur, India
[2]Karbala Technical Institute, Al-Furat Al-Awsat Technical University, Karbala, Iraq
**Corresponding Author: touseefmd.anu@gmail.com*

ABSTRACT: *India is the world's second-largest producer of rice, which contributes significantly to the GDP of the country, burning rice stubble, is one of the most serious issues facing by the nation. Farmers are usually directed to mix the residue into the soil, although this management option is limited due to the residue's slow breakdown qualities in the soil and the potential to spread rice diseases. The government has strictly restricted this practice.*

Since a lot of lab-scale and commercial research has been done on rice straw-based nano-composites, rice straw-based FRP is a relatively new technology that has not received much attention. The creation of biodegradable FRPs, decomposable plates, and bricks from rice stubble has only been attempted by a few researchers. The technology that has been developed not only eradicates the issue of pollution by burning stubble, but it also tackles the issue of synthetic plastics. The current study is to determine to explore the feasibility of whether it is possible to convert this agricultural waste into biodegradable products that are beneficial for agroecological and sustainable development. We have developed the FRP using a hand layup process with rice stubble. The mechanical properties of the resulting composites were evaluated through tensile, flexural, impact, water absorption, and hardness tests. Results demonstrated promising tensile and flexural strength, with notable impact resistance and water absorption properties. Specimen C1 exhibited superior tensile strength (12.55 MPa), while Sample-2 showed the highest impact toughness (2426.52 J/m²). The study suggests that rice stubble composites could serve as a sustainable, cost-effective alternative to conventional materials, providing environmental benefits by reducing stubble burning and promoting material recycling.

Keywords*: Rice stubbles, FRP materials, Agricultural waste, sustainable development.*

"Eco-Friendly Use of Rice Huskash by Partially Replacing Cement and Sand in Concrete" An Experimental Study

Rajashree Panda[1,*], Priyanka Priyadarsini[2]
Dept. of Civil Engineering, Vignan Institute of Technology & Management, Berhampur, Odisha, India
**Corresponding Author: rajashree.panda13@gmail.com*

ABSTRACT: *Purpose: - The primary objective of this study is to determine the optimum amount of waste material i.e. Rice Husk Ash (RHA) for partial replacement of conventional materials i.e., cement or sand used for making concrete without compromising its properties.*

Design/methodology/approach: - This paper presents a detailed experimental study on density and compressive strength at age of 7 and 28 days. Design mix M40 grade concrete has been used in this study. Density and compressive strength were determined by partially replacing both cement & sand by 5%, 10%, 15% & 20% in two phases. In the 1st phase cement was partially replaced. In the 2nd phase sand was partially replaced.
Findings: - It was observed that, the concrete mixture prepared by partially replacing the fine aggregate i.e. sand with RHA has less density as compared with the concrete mixture prepared by partially replacing cement with RHA & the controlled mix. The compressive strength of concrete mix prepared by partially replacing cement with RHA is more than that of concrete mix prepared by partially replacing sand with RHA at 7 days. But at 28 days, the compressive strength of concrete mix prepared by partially replacing sand with RHA increased than that of concrete mix prepared by partially replacing cement with RHA.
Implications: - RHA significantly contributes to the increase in compressive strength and reduction in density. Using RHA in place of cement or sand could help to lower building costs.
Originality/value: - Several studies have been conducted on the replacement of cement with RHA. However, there is limited research on the replacement of sand with RHA. This study examines the replacement of cement or sand with RHA for preparing concrete.

Keywords*: Waste minimization, Cement, Replacement, Concrete, Rice husk ash, Sand.*

Design of Claw based Robotic Arm using 3D Printing Technology for Salvage Operation

Kartik Sonawane[*], Vivek Todkar, Prathamesh Shedale, Tanmay Belamkar
Fr. C. RODRIGUES INSTITUTE OF TECHNOLOGY, Electronics and Telecommunication, India
**Corresponding Author: sonawanekartik145@gmail.com*

ABSTRACT: *The integration of claw-based robotic arms with 3D printing technology presents a novel approach for enhancing salvage operations. This study explores the design, development, and implementation of a 3D-printed robotic arm equipped with a versatile claw mechanism, tailored specifically for retrieving objects in challenging environments. Leveraging the precision and customization capabilities of 3D printing, the robotic arm is fabricated using lightweight yet durable materials, ensuring both efficiency and robustness in various salvage scenarios. The design of the 3D-printed claw-based robotic arm aims to minimize the necessity for human intervention in salvage operations. The claw-based robotic arm is engineered to handle a wide range of objects, from delicate items to heavy debris, with adjustable gripping force and adaptive control mechanisms. By combining autonomous capabilities with remote control options, these robotic arms offer a robust solution for retrieving objects in challenging environments. Salvage operations often involve recovering valuable materials, equipment, or vessels from environments that are dangerous, difficult to access, or otherwise inhospitable to humans, such as deep-sea locations, collapsed buildings, or disaster zones. In these scenarios, robotic arms play a crucial role due to their ability to perform precise, controlled movements in environments where human presence is limited or impossible.*

Keywords*:*

Design and Fabrication of High Altitude Remote Autonomous Afforestation Drone

D Raj Kumar*, V Dharani Sri, P Parthiban, S Kannika, G Janani, T Rajeshwari
Aeronautical Engineering, Paavai Engineering College, Namakkal, Tamil Nadu, India
**Corresponding Author: rajkumarpgi@paavai.edu.in*

ABSTRACT: *The project aims to develop a "High Altitude Remote Autonomous Afforestation Drone" to address the inefficiencies of traditional afforestation methods, particularly in remote and inaccessible areas. This technology seeks to enhance the speed, efficiency, and scalability of tree-planting efforts, contributing to climate change mitigation and ecosystem restoration. An autonomous drone is designed to operate at high altitudes, equipped with a GPS navigation system, a seed dispenser, and a precision planting mechanism. The drone can autonomously travel to specific locations, dispense seeds accurately, and ensure proper depth and spacing for optimal growth. It can cover large, remote areas and return to its base station without manual intervention. The entire system can be controlled remotely, enabling afforestation in challenging terrain. Initial tests indicate that the drone-based system significantly outperforms traditional afforestation methods in terms of speed and coverage. It is less labor-intensive and more efficient, particularly in remote regions. The precision planting mechanism ensures better seed placement, and the autonomous nature of the drone reduces the risks associated with human intervention in difficult environments. This technology has the potential to revolutionize large-scale afforestation efforts by lowering costs, improving efficiency, and allowing access to previously unreachable areas. It offers a sustainable, scalable solution for restoring deforested areas and combating climate change. The use of autonomous, high-altitude drones for afforestation is an innovative approach, offering a novel solution to the limitations of traditional methods. This project provides a new avenue for environmental conservation and sustainability through advanced technology.*

Exploring Terracotta: An Emerging Trend in Product Design

Anshul Goyal*
India
**Corresponding Author: anshul.goyal.121991@gmail.com*

ABSTRACT: *Terracotta, traditionally known for its use in pottery and architecture, is experiencing a resurgence as a prominent trend in contemporary product design. This paper examines the evolving role of terracotta as a versatile material across various industries, including interior décor, fashion, architecture, and consumer goods. The resurgence of terracotta stems from its inherent qualities, such as its warm, earthy hue and tactile texture, which evoke a sense of authenticity, connection to nature, and nostalgia. Designers and manufacturers are increasingly integrating terracotta into their product lines to capitalize on these aesthetic and emotional appeals. This paper delves into the reasons behind the popularity of terracotta, including its sustainability credentials, its ability to harmonize with modern and traditional aesthetics, and its adaptability to diverse design styles and applications. Moreover, it explores the cultural and historical significance of terracotta and its influence on contemporary design trends. Furthermore, the paper highlights case studies and examples of innovative uses of terracotta in product design, ranging from furniture and lighting fixtures to textiles and electronic gadgets. It also discusses the challenges and opportunities associated with working with terracotta, such as its fragility, weight, and production processes. As terracotta continues to gain momentum as an emerging trend in product design, this paper aims to provide insights and inspiration for designers, manufacturers, and consumers interested in embracing this timeless and versatile material in their creative endeavours. The 2023 Garden Trends Report by Garden Media has unveiled terracotta as the color trend of the year, and it's easy to understand why given its rich history and symbolism. Over time, the utilization of terracotta has evolved alongside advancements in technology. Present-day terracotta products boast enhanced strength and durability, rendering them suitable for both indoor and outdoor use. With deep historical roots, the color orange carries spiritual significance. It emerged as a prominent hue during the transformative era spanning the 1960s and 1970s — a period characterized by change, peace, love, and a psychedelic aesthetic. Transitioning from the vibrant tones of the '60s, the aesthetics of the '70s shifted towards more natural hues, including the transition of Acid Orange into the elegant terracotta shade prevalent today. Earth tones predominated this era, coinciding with the inception of the "earth movement" in 1970, catalyzed by the inaugural Earth Day celebration. (Source: Garden Media | Garden Trends 2023).*

Sustainable Machining Techniques with Recent Advances in MQL and Hybrid Systems

M. Karthikraja*, P. Kalidoss, S. Anbu, P. Prabakaran
Mechanical Engineering, Dhanalakshmi Srinivasan University, Trichy, India
**Corresponding Author: prabakaranpalanisamy4312@gmail.com*

ABSTRACT: *As in the modern manufacturing, waste production minimized machining techniques to increase tool life, surface quality, and environmental efficiency is gaining importance. This work addresses Minimum Quantity Lubrication (MQL), air-mist cooling, cryogenic-MQL hybrids and nano lubrication systems, all of which are current types of sustainable machining processes. The internal and exterior MQL cooling systems have been shown to decrease the cutting forces, temperatures and surface roughness when used in milling, drilling, and turning operations, with improved tool life and efficiency. For cutting stainless steel and titanium alloys, the additional advantage of air mist MQL systems is enhanced mist deposition and decreased friction. Furthermore, these cryogenic liquid nitrogen (LN2), Cryogenic CO2 (LCO2) hybrids significantly enhance machining sustainability and precision, resulting in successful tool wear reduction, heat stress reduction and the reduction of white layers. These techniques further develop hybrid nano lubricants that improve lubrication and reduce tool wear, while enhancing surface quality. Nozzle design innovations, including dual nozzles and ultrasonic spray, are examples of improved lubrication efficacy facilitating lowering of friction, surface roughness, and energy consumption. This article provides a thorough examination of these new technologies in terms of their effect on the machining performance. Use of these sustainable approaches may help manufacturers solve manufacturing related operational and environmental problems besides maximizing machining efficiency, thus creating more options for environmentally friendly manufacturing solutions.*

Keywords*: Sustainable machining process, Minimum quantity lubrication (MQL), Cryogenic cooling, Nano lubricants, hybrid system.*

A Review on Design Perspective of Line Following Robot

A.S. Aradhye*, M. S. Shinde, M. S. Zurer, N. A. Anpat, P.J. Dhere
Department of Mechanical Engineering, SKN Sinhgad College of Engineering, Pandharpur, Punyashlok Ahilyadevi Holkar Solapur University, Solapur, India
**Corresponding Author: atul.aradhye@sknscoe.ac.in*

ABSTRACT: *Using differential drive mechanisms, line-following robots travel by observing a visible path, like a black or white line. To ensure performance, stability, and speed control, its movement is managed using strategies such fuzzy logic systems and PID controllers. Accuracy depends on path detecting techniques, such as optical encoders, IR sensors, photodiodes, and camera-based image processing concepts, workings, and technologies of line-following robots, with a focus on planning algorithms and path recognition methods. Line-following robots have been extensively studied, although the design parameters have received less attention. By addressing those design aspects, this research adds fresh perspectives to the area. This paper addresses those design aspects, contributing new insights into the field.*

Keywords*: Robot, Path detection, Robotics.*

3D Printing of Earthen Materials - Fostering Sustainable Innovations

Bhagyashree Khandare*, Surendra Nadh Somala
Civil Engineering Department, Indian Institute of Technology, Hyderabad, India
**Corresponding Author: ce21resch01002@iith.ac.in*

ABSTRACT: *This study investigates earthen 3D printing as a sustainable housing solution, addressing the construction industry's urgent need for eco-friendly practices. Utilizing the oldest and most readily available material, like soil, we aim to minimize carbon footprints and promote biodegradable alternatives to conventional building materials. By revisiting traditional building techniques and harnessing the power of additive manufacturing, we strive to develop innovative, nature-inspired construction methods that prioritize sustainability, climate efficient designs and energy efficiency. This work also involves conducting various geotechnical tests to study the rheological properties and actual soil type available in the local area. Exploration of biodegradable materials is done to enhance the properties of locally available soil to make it printable. A brief study on the trial of topology optimization application in construction is studied, which allows for the design of lightweight and efficient structures that utilize minimal material while maximizing strength and performance, which enables the complex geometries, fostering sustainable building practices by reducing waste and enhancing the ecological benefits of using natural materials. So, this work combines modern technology of additive manufacturing with traditional materials, developing the future from its roots in the past.*

Keywords*: Sustainable construction, earthen materials, 3D printing, green buildings, topology optimization, climate efficient designing.*

Self-Healing Concrete of Annona Muricata Leaves Powder: A Study on Strength and Structural Properties

Malathy Ramalingam*, Deepalakshmi Damotharan, Abhishek Kumar Keerthivasan, John Abishek, Naveen Kumar
Department of Civil Engineering, Sona College of Technology, India
**Corresponding Author: malathycivil@sonatech.ac.in*

ABSTRACT: *Annona muricata is a member of the Annonaceae family and is a fruit tree with a long history of traditional use. From the journal studied, we have found that Annona muricata has some self healing properties in the leaves. In this paper, we describe the influence of annona muricata leaves powder in concrete that makes it into a self-healing concrete. Self- healing concrete is a type of concrete that is designed to mimic the structural and self-healing properties found in natural materials. In this paper, a study on the self-healing ability Self healing concrete using Annona muricata leaves specimens has been presented. The analysis is focussed on the recovery of regained strength of the cracked specimens by quantifying the self-healing effectiveness of Annona muricata leaves powder and comparing. The test result shows that, Compressive Strength test comes at the range of 25 N/mm2 to 32 N/mm2 which gains more strength than conventional block, Split tensile test comes at the range of 1 N/mm2 to 5 N/mm2 which gains more strength than conventional block, Concrete with leave powder is also able to absorb moisture content from atmosphere, thus resulting in considerable amount self-healing i.e. 70%. From the SEM analysis, based on the observed microstructural features, elemental distributions, and the interplay between powder and the concrete matrix the Ca and Si content is higher as compared to that of conventional concrete also it is confirmed that C-S-H gel and CaCO3 are the self-healing products. From the XRD analysis, can confirm the presence of CSH gel and CaCO3 in self-healing concrete. This confirmation provides valuable insight into the effectiveness of self-healing mechanisms and their contribution to the performance of the concrete material. FTIR transmission spectra results showed the significant bond formation and mechanism of the self-healing property of the concrete with coarse aggregate. The results shows that the concrete can selfheal the crack.*

Keywords*: Self-healing concrete, Annona muricata leaves, Healing Crack and Strength Regain.*

Smart Orthotic Leg monitoring system: IOT enabled sensor integration, data analytics and cloud storage for orthotist analysis

OM Barde*

Sinhgad Institute of Technology, Lonavala, India

**Corresponding Author: omkiranbarde@gmail.com*

ABSTRACT: *The global population is aging, and this trend is leading to an increase in physical and health challenges, particularly musculoskeletal disorders that impair mobility. The loss of mobility due to these disorders can have severe social, mental, and physical consequences. Early diagnosis and continuous monitoring of joint movements can mitigate these effects. This paper reviews various methods for joint monitoring using advanced sensor technologies. By combining miniaturized, durable, low-cost sensors with modern communication and data processing techniques, smart joint monitoring systems can track and record critical joint-related parameters. These systems can assist in daily mobility monitoring or during post-surgery recovery. The study presents a comparative analysis of joint monitoring methods, sensors, and data interpretation techniques, as well as current research trends and challenges in the field.*

The paper provides a comprehensive review of methods for monitoring human body joints, particularly focusing on technological advancements and research challenges in the field. As populations age, mobility loss due to musculoskeletal disorders has become a critical issue, especially among older adults. The paper highlights the importance of early diagnosis and continuous joint monitoring to manage conditions like arthritis. Wearable sensor technology is at the forefront of these solutions, offering real-time, non-invasive monitoring during daily activities and rehabilitation processes. Various sensors, including optical, textile-based, and inertial measurement units (IMUs), are discussed in terms of their principles, advantages, and limitations for tracking joint angles, motion, and skeletal positions. The comparison between different sensor technologies highlights the trade-offs in accuracy, cost, size, and ease of integration. Optical fiber sensors, for example, provide high precision but are sensitive to environmental factors, while IMUs offer compact and affordable solutions for 3D tracking. The review also addresses current research gaps, including the need for improved sensor fusion techniques, better data analysis algorithms, and more user-friendly systems that can be seamlessly integrated into everyday life. The paper concludes by identifying future research directions, emphasizing the development of smarter, more efficient, and cost-effective joint monitoring systems to meet growing healthcare needs.

Keywords*: wearable sensors, joint angles, range of motion (ROM), skeletal tracking, goniometers, optical sensors, textile-based sensors, and inertial measurement units (IMU).*

Edible cartularies production a sustainable livelihood through technical innovation to the particular vulnerable tribal groups of Jharkhand

Sudip Banerjee[1,*], Dilip Kumar[2]

[1]Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India
[2]Gopal Narayan Singh University, Sasaram, India

**Corresponding Author: b_sudeep@rediffmail.com*

ABSTRACT: *Eastern India Jharkhand is the state where Particularly Vulnerable Tribal Groups are economically weaker and less educated. There is a need for the employment of these people for their livelihood. India is the county produces a huge quantity of food grains like wheat, rice, etc. so take advantage of these using innovative technologies there is an opportunity to deliver eco-friendly products that can be nutritious and tasty so this paper tries to highlight the scope of edible cartlaries business in Jharkhand and create a sustainable livelihood to the Particular Vulnerable Tribal Groups of Jharkhand. This type of initiative also encourages promoting Entrepreneurship among the vulnerable group of people.*

Keywords*: Edible cartlaries, Tribal, PVTGs, Jharkhand Sustainable livelihood, Entrepreneurship.*

Palm Oil Expansion and Ethnic-Based Violent Conflict in Indonesia Post New Order

Muhammad Mahsun*
State Islamic University Walisongo
**Corresponding Author: muhammad.mahsun@walisongo.ac.id*

ABSTRACT: *Natural resources and conflict are topics that have drawn significant attention from scholars around the world. Some perspectives argue that there is a strong connection between the natural resource industry, poverty, and conflict escalation in developing countries. Meanwhile, others contend that natural resource exploration fosters elite capture over state institutions, rent-seeking practices, and the displacement of communities from their land. Applying a qualitative method and a political economy perspective, this article analyses the mechanisms linking palm oil plantation expansion to violent conflicts among local communities in South Sumatra and East Kalimantan, Indonesia. The findings of this research indicate that the large-scale expansion of palm oil plantations following the collapse of the New Order not only leads to environmental degradation and conflicts between plantation companies and local communities but also engenders diverse patterns of ethnic-based violent conflict among local communities residing near palm oil plantations. I argue that violence and violent conflicts in various forms are socio-political phenomena inherent within the structure of palm oil plantations and the surrounding communities, intentionally created and perpetuated by multiple parties. Furthermore, such conflicts and violence have become a daily strategy for local communities to address poverty resulting from their loss of access to vital living spaces (land and forests) seized by palm oil companies. As a result, communities around palm oil plantations face the threat of poverty and structural conflict, leading to other forms of violent practices, such as assault, robbery, as well as drug and firearms trafficking.*

Keywords*: palm oil expansion, violence, conflict, identity, Indonesia.*

A Study on Brain Tumor Detection Using Explainable AI

Shraddha Kaushal*, Harsh Gour, Sonali, Gazab Bhati, Arun Kumar Rai
Greater Noida Institute of Technology,GNIOT (affiliated to AKTU), Uttar Pradesh, India
**Corresponding Author: shrddhkshl@gmail.com*

ABSTRACT: *Due to the growing concern of brain tumors and the need to develop better diagnostic methods against brain tumors in the medical imaging field, we introduce a new model of brain tumor detection with the use of sophisticated AI techniques that improve its efficiency and interpretability. This systematic approach comprises seven key phases. The framework directly utilizes MRI datasets, and there is always an availability problem since the datasets are obtained from the public domain; however, to maintain a high quality of the data infrastructure, data cleaning procedures, normalization, and augmentation have been considered. Predominantly, we use a model namely as TUMOR-NET XAI that acts as a combination of CNNs to extract the features and attention since the MRIs mostly attend on the tumor region, followed by different categories of classifiers namely, Random forest and SVM. In order to enhance interpretability, we use the IFAV approach, which integrates SHAP, Grad-CAM, and LIME to identify the features that affect the model's predictions. The resultant model not only attains a high degree of diagnostic accuracy, but also helps clinicians build trust in its diagnosis by providing plain and easily understandable interpretation of its inferences. This framework seeks to fill the existing gap between the state-of-the-art computational algorithms and the routine clinical use, with the sight of improving the performance of brain tumor detection in healthcare.*

Keywords*: Explainable AI, SHapley Additive exPlanations (SHAP), Gradient-weighted Class Activation Mapping (Grad-CAM), Convolutional Neural Network(CNN), Brain Tumor Detection, Integrated Feature Attribution and Visualization(IFAV), Deep Learning(DL), Machine Learning(ML), Modified deep convolutional neural network (MDCNN).*

A Hybrid Approach for Dog Breed Classification

C A Rishikeshan*, Jayanthi R, Piyush Singh, Sushmit Songara
Vellore Institute of Technology (VIT) Chennai, India
**Corresponding Author: rishikeshan.ca@vit.ac.in*

ABSTRACT: *This study introduces a hybrid deep learning approach for dog breed classification, combining MobileNetV2 and ResNet50 architectures to enhance feature extraction from images. The integration of these models aims to capitalize on MobileNetV2's efficiency and ResNet50's deep feature learning capabilities, resulting in improved classification performance across diverse dog breeds. This approach addresses the challenge of recognizing subtle visual differences between breeds, offering a robust solution for large-scale image classification tasks. The proposed model's versatility makes it suitable for applications in veterinary services, pet identification, and animal welfare, contributing to advancements in automated visual recognition systems.*

Keywords*: Resnet50, MobileNetV2, Hybrid Model, Dog Breed Classification.*

Bridging Waste Management and Circular Economy: Unlocking the Potential of Preparing for Reuse

Rikke Marie Moalem*
Department of Sustainability and Planning, Aalborg University, Denmark
**Corresponding Author: rikkekr@plan.aau.dk*

ABSTRACT: *Preparation for reuse (PfR) occupies the highest priority in the European Union's waste hierarchy, emphasizing the treatment of waste at the product level rather than as mere materials. This approach aligns with circular economy (CE) principles, leveraging the "power of the inner cycles" to minimize resource consumption and environmental impact by prioritizing reuse and repair over recycling and incineration. Despite its potential, PfR faces significant barriers to mainstream adoption in Denmark, largely due to rigid regulations and entrenched systemic "lock-ins" rooted in historical power struggles between public and private sectors in waste management. This paper explores how municipal waste management companies can bridge the gap between CE principles and prevailing waste practices, which still predominantly focus on recycling and incineration. Preliminary studies demonstrate that PfR fosters a more circular approach by reintegrating waste products into the value chain as resources, thereby extending their lifespan and aligning with EU waste hierarchy goals. While these practices highlight potential for collaboration and innovation at the community level, they also reveal ambivalent tensions between traditional waste management systems and circular solutions. Drawing on empirical evidence from Denmark, the study identifies mechanisms to overcome existing barriers and highlights the role of municipal waste management in advancing CE practices. It demonstrates how repair and reuse activities can thrive through redefined PfR priorities, even within a challenging regulatory landscape. This represents a crucial step toward a more sustainable, resource-efficient waste management system, fostering waste prevention and reducing environmental impacts in line with CE objectives.*

Keywords*:*

Damage Detection of Bridges Using Uav's A Case Study

M.N.A Gulshan*, Taj R. Ilavarasan
Sona College of Technology, Salem, Tamil Nadu, India
**Corresponding Author: gulshantaj@sonatech.ac.in*

ABSTRACT: *Bridges are critical components of transportation infrastructure, necessitating timely detection and assessment of structural damage for safety and functionality. Unmanned Aerial Vehicles (UAVs) equipped with advanced sensors offer a promising solution for efficient and accurate bridge inspection. This paper reviews recent advances in UAVbased bridge damage detection techniques, including image processing, machine learning, and remote sensing. Key challenges such as image quality and regulatory constraints are addressed, along with potential solutions. Case studies and experimental results demonstrate the practical feasibility and benefits of UAVs for bridge inspection. Overall, this paper highlights the transformative potential of UAV technology in enhancing infrastructure maintenance and monitoring.*

Keywords*: Bridge inspection, UAV, damage detection, image processing, machine learning, remote sensing, infrastructure maintenance.*

XIV. Packaging

Modified Atmosphere Packaging as a Sustainable Tool for Food Preservation

Srinivas Bikkina[1,*], Adinarayana Rao[2]

1Vingas Industries Private Limited Gajuwaka, Visakhapatnam, India
2Department of Operations & Supply Chain, GITAM School of Business, GITAM (Deemed to be University), Visakhapatnam, India

**Corresponding Author: bikkinasr@gmail.com*

ABSTRACT: *The global food system is facing challenges because of population growth, climate change, and the depletion of arable land. This threatens food security and sustainability. While increasing food production is the need of the hour, an interesting idea is to extend food's shelf life, thereby accomplishing food sustainability to a certain extent. Modified Atmosphere Packaging (MAP) is an innovative technology to enhance food preservation, reduce waste, and enhance food availability. MAP is the practice of modifying the composition of the internal atmosphere of a food package to improve its shelf life. MAP works by altering the gaseous environment surrounding food within its packaging, thereby extending shelf life and maintaining quality without chemical preservatives. This study reviews the literature on MAP, including its history, gases used, and practical applications. It also explores the advantages and challenges of MAP implementation and discusses its role in reducing food waste and promoting food sustainability. MAP does have challenges in ensuring proper gas composition, packaging materials, and refrigeration during storage. Further research and technological advancements are needed to optimize MAP applications and address the challenges associated with its implementation. Insights from this research will help stakeholders in the food, nutrition, and packing industry so that food waste can be avoided apart from making varieties of food accessible at marketplaces that previously could not be afforded because of the short shelf life of food items.*

Keywords*: modified atmosphere packaging, food preservation, food sustainability, food waste reduction, shelf-life extension, food security, packaging materials, food quality, gas composition.*

Effect of Packaging Materials on the Shelf Life of Nagpur Mandarin [Citrus reticulate Blanco]

Bablu K. Chaudhari[*], S.L. Sharma

Department of Agriculture, Jagannath University, Jaipur, India

**Corresponding Author: bablu_chaudhari25@yahoo.in*

ABSTRACT: *An investigation was conducted at International Horticulture Innovation and Training Centre (IHITC), Durgapura Horticulture Farm, Durgapura, Jaipur, Rajasthan during the academic year 2021-2022 to study the effect of various packaging materials on fruit quality and shelflife of Nagpur Mandarin of Ambia and Mrig Bahar respectively. The study was conducted from 10th February to 31"March 2022 of Mrig Bahar and 5th November to 24th December 2021 of Ambia Bahar. The packaging materials include wooden crate, plastic crate, corrugated fibre box, polythene and Net mesh bag were used for experimentation in both Bahar. Liquid paraffin wax (10%) was used as a coating material. Physiological weight loss (%) in Ambia and Mrig Bahar were on similarity with each other 8 days after storage in cold storage respective of controlled temperature and Relative Humidity (8±2°C and 90±5% R.H. i.e., Relative Humidity). Observations at 50 days after storage revealed that the fruits under treatment T18 (Corrugated box with 10% wax at cold storage) and T20 (HDPE with 10% wax at cold storage) expressed better value for fruit mass and fruit length. Packaging and post-harvest treatments significantly influenced certain other physical traits in Mandarins of both Bahar. In both the cases, the fruits under treatment Tl7 and T20 registered maximum value at 36th day after storage. In case of quality related traits, the fruits under treatment T20 recorded the maximum value for TSS and TA when compared with other packaging treatments including control at 50th day after storage in Ambia and Mrig Bahar. For various packaging treatments, the fruits under the treatments with wax coating in CFB and Polythene bag in cold storage with wax coating retained maximum where the quality of fruits was maintained on 50th day of storage. With regard to remaining quality related traits, the fruits under Tl 8, 19 & 20 expressed the maximum value for TSS: acid ratio, TSS, Ascorbic acid content at 50th day after storage. The major benefits of cold storage and packaging fruits in polythene and CFB are: (i) a longer shelf life; (ii) less weight loss; (iii) less fruit deformation; (iv) less chilling injury; and (v) less decay due to the prevention of secondary infection of fruits packed in the same box which is ideal for domestic market and export internationally.*

Food Waste Derived Biodegradable Packaging: A Sustainable Solution for a Growing Environmental Problem

Baidik Sinha Ray, Souptik Bhattacharya*, Dolanchapa Sikdar*
Department of Food Technology, Guru Nanak Institute of Technology, Kolkata, West Bengal, India
**Corresponding Author: souptik.bhattacharya@gnit.ac.in, dolanchapa.sikdar@gnit.ac.in*

ABSTRACT: *The global problem of increasing amount of plastics and micro plastics in the environment especially the packaging materials requires new environmentally sustainable materials. As one of the major causes of environmental issues, food waste can be a particularly attractive source for generating sustainable biodegradable packaging materials. Biodegradable packaging having its origin from renewable sources of production has been deemed to be an effective substitute for the common plastics. Food waste; a global issue that directly affects the environment, can be utilized to produce renewable packaging materials. This paper aims at establishing that food waste can be viewed as a renewable and sustainable resource of biodegradable packaging. It also looks at different sources of food waste, methods of processing and new methodologies in the development of optimum bioplastics. On the same note, the paper evaluates the environmental footprint of packaging made from food waste and the benefits thereof; biodegradability, composability, utilization of renewable resources as compared to conventional packaging. Moreover, it presents the prospects and the limitations of scaling up this technology as the market for sustainable packaging materials continues to grow. Furthermore, this approach eliminates the use of fossil fuels and minimizes plastic waste while contributing to the establishment of a circular economy through the diversion and upcycling of food waste.*

Keywords*: Food Waste, Biodegradable Packaging, Composability, Environmental Impact.*

Corn Stalk Pith: A Sustainable Substitute for Traditional Bio-Packaging Materials

Kakali Bandyopadhyay, Riya Dasgupta, Rituparna Das*
Department of Food Technology, Guru Nanak Institute of Technology, Panihati, West Bengal, India
**Corresponding Author: dasrituparna740@gmail.com*

ABSTRACT: *Zea Mays, commonly known as Corn, is a mono-corollaceous plant and belongs to the family of Poaceae. This plant is native in Mexico and widely grown by Indian farmers. The major growing states in India includes Maharashtra, Karnataka, Rajasthan and Bihar etc. India contributes 47% to the global production of Corn in the financial year 2023-2024. The post-harvest processing of corn generates significant amount of waste in the form of Corn pith, leaves etc. These by-products from corn processing industries are often underutilized. The utilization of by-products from argo processing wastes has been found to be worth king's ransom. Therefore, the present study aims to focus on the aspect of utilization of corn pith as a sustainable source for bio-packaging. Corn pith is made up of high cellulose content, low lignin content and low in density and has a spongy, highly elastic porous like structure. It is an excellent renewable packaging material with improved physio-chemical properties This review focuses on the techniques used to extract and process corn stalk pith to an acceptable and feasible packaging material. It then looks into the detail on the uses of corn stalk pith-based packaging where through its packaging use as biodegradable films. In addition, the research describes the challenges encountered when using corn stalk pith in packaging for instance poor mechanical properties, hygroscopicity, and biodegradation. Further, the current investigation on the physical and mechanical characteristics of chemically modified corn stalk pith materials and composites production are also reviewed. Moreover, the research focuses on future outlooks of corn pith value addition to promote a green economy.*

Keywords*: Corn pith, Argo processing wastes, Bio-packaging, Physio-chemical properties, Biodegradable films.*

Sustainable Packaging for Online Food-Delivery: A Comparative Analysis of Materials used in India

Aarti Sachdeva[1,*], Divya Tiwari[2]

[1]Lead-Knowledge Development, Saahas, Bangalore, India

[2]Circular Economy, Saahas, Bangalore, India

**Corresponding Author: aarti.sachdeva@saahas.org*

ABSTRACT: *Plastics continue to dominate the packaging industry due to their inherent cost advantage & versatility; though in some cases, alternate materials are also in use. There is no existing policy framework governing the use and disposal of Packaging Materials (PM) other than plastic, and even that is silent on food delivery packaging. Evaluating the choice of PM is critical not just from an environmental standpoint, but since these materials come in direct contact with food, they have a potential impact on health as well. Current literature that investigates these intersectional parameters are available in silos. Therefore, this research work amalgamates the results of various relevant studies and combines it with practical observations on cost and physical properties to arrive at a colour coded rubric for seven types of single use PM. Agri-residue based packaging was found to be the best option considering the four parameters i.e. environmental impact during production, disposal (ideal & existing scenarios); impact on health from packaging made with virgin & recycled materials; Cost (to the user & to the society); and Physical properties (durability, leak resistance and moisture barrier). Emerging examples showcasing the re-use models were also considered to highlight the critical success factors of reusable food packaging in food delivery business.*

Keywords*: Food delivery, Packaging materials, Plastics, Sustainable solution, India.*

The Influence of Green Packaging on the Sustainable Development of Food Processing SMES In Kano

Amina Ibrahim Mahe*

Department of Management, Skyline University Nigeria, Kano

**Corresponding Author: amina_mahe@yahoo.com*

ABSTRACT: *This study examines the influence of green packaging on the sustainable development of Small and Medium Enterprises (SMEs) in the food processing sector of Kano State, Nigeria. As global environmental concerns rise, the adoption of green packaging has become crucial for reducing ecological footprints and enhancing sustainability. This study explores how green packaging practices impact the economic, social, and environmental dimensions of sustainability among food processing SMEs in this region. A mixed-methods approach was employed, combining quantitative surveys and qualitative interviews with SME owners and managers to gather comprehensive data. The quantitative component involved a structured questionnaire distributed to a sample of 30 food processing SMEs, aiming to assess the extent of green packaging adoption, perceived benefits, and challenges faced. Quantitative analysis demonstrates a positive correlation between the adoption of green packaging and various indicators of sustainable development, such as cost efficiency, resource conservation, and customer loyalty. Key findings underscore the importance of strategic investments in sustainable packaging technologies and materials and capacity-building initiatives to enhance SMEs' capabilities in green innovation. Moreover, collaboration across the supply chain and partnerships with governmental and non-governmental organizations are crucial in scaling up green packaging initiatives among SMEs in Kano. In conclusion, this study contributes to the growing body of literature on sustainable development by highlighting the transformative role of green packaging in enhancing the resilience and competitiveness of food processing SMEs in Kano. Recommendations include policy interventions that promote sustainable practices and incentives for SMEs to invest in environmentally responsible packaging solutions.*

Keywords*: Green packaging, Sustainable development, Food processing SMEs, Environmental sustainability*

Causal Factors Influencing the Use of Eco-Friendly Food Packaging in Ibaan, Batangas' Micro, Small, and Medium-Sized Businesses' (MSMEs)

Alain Jomarie G. Santos[1,*], Allyah DC. Matira[1], Elisha Ma. Andrea Palad[1], Zosimo O. Membrebe Jr.[2]

[1]University of Santo Tomas Faculty of Arts and Letters, Philippines
[2]Dela Salle University – College of St. Benilde, Philippines

**Corresponding Author: agsantos@ust.edu.ph*

ABSTRACT: *The COVID-19 pandemic has had a significant impact on the Philippines' food service sector. One consequence would be the sharp drop in dine-in orders and the rise in takeout orders. The number of single-use plastics, which eventually become waste, also rose as a result of the takeout industry's exponential demand. The study was conducted in Ibaan, Batangas, with the goal of identifying the variables that influence the adoption of environmentally friendly packaging and how much it contributes to the town's waste management efforts. It also sought to ascertain how different elements influencing a company's packaging decision relate to waste management promotion and how to encourage food-service MSMEs in Ibaan, Batangas, to use environmentally friendly packaging. The researchers looked into the relationships between variables using a quantitative correlational design. According to the study's findings, the town's MSMEs chose packaging that is long-lasting, portable, sustainable, and appealing to consumers. According to the Pearson's correlation coefficient, eco-friendly food-service packaging does not significantly contribute to the promotion of waste management, and the majority of internal and external business environmental factors influence the respondent's choice of packaging. In order to ensure the maximum effectiveness of waste management policies and actions through sustainability, assessment, and restructuring of the management of food-service MSMEs, the researchers advise the Local Government Unit to support its MSMEs by giving them adequate funding and improving their waste management plans, in support of the United Nations Sustainable Development Goal 12 about ensuring sustainable consumption and production patterns.*

Keywords*: Waste Management, Sustainability, MSME, Eco-friendly packaging, UN SDG Goal 12*

Affordable and Environment friendly: The Shift towards Sustainable Packaging

N lalitha*, Sybil Justus Sam

GITAM School of Business, Gandhi Institute of Technology and Management, deemed to be University, Visakhapatnam, India

**Corresponding Author: lnammi@gitam.edu*

ABSTRACT: *Manufactures and producers often produce their goods in smaller sachets, packets and other smaller compact packaging format to either enter the market or to cater the economically weaker section of the society or the middle –class. This approach makes the products more accessible and affordable to the society. These are mostly one time use products or single time use products. Since it is affordable and easily accessible it is preferred by many. This contributes significantly to environmental pollution in the form of plastic waste accumulation, soil contamination and may also have a huge impact on climate and wildlife. If Biodegradable/ recycled packaged material are adopted in the manufacturing and producing of product it could render a better solution to the environmental concerns. Initial transitioning to a sustainable solution would require investment in new technologies and materials, but the long term benefits in the form of lower carbon footprint, reduced pollution and resource conservation are substantial. This study would aim to highlight the practicality of adopting environment friendly packaging and also try to bring a solution for sustainability and resource conservation. This study would also aim to help in manufacturers and producers to come up with some better solutions to cater to the people of economically weaker section.*

Keywords*: Sustainability, Consumer behavior, Market, Packaging*

XV. Plastic Waste Management

Innovative Approaches to Plastic Waste Management in the Mekong Basin: Integrating Technology, Community Engagement, and Regional Collaboration

Kititphon Boonma[1,*], Sujitra Vassanadumrongdee[2], Uch Rithy[3] , Souvanna Phengsisomboun[4], Ngoc Kim Thi Thuy[5], Hoa Tran[6], Thuy Vo Nguyen Minh[7], James Scott[8], Spoann Vin[9]

[1]Geoinformatics Center, Asian Institute of Technology, Thailand
[2]Environmental Research Institute of Chulalongkorn University, Thailand
[3]The Environmental Education and Recycling Organization (COMPOSTED), Cambodia
[4]National University of Laos, Lao PDR
[5]The Institute of Strategy, Policy on Natural Resources and Environment (ISPONRE), Vietnam
[6]Centre for Supporting Green Development (GreenHub), Vietnam
[7]ClearRivers, Vietnam
[8]TerraCycle Foundation Thailand, Thailand
[9]Royal University of Phnom Penh, Cambodia

**Corresponding Author: kboonma@ait.ac.th*

ABSTRACT: *The Mekong Basin, a region of immense ecological and economic significance, is increasingly threatened by plastic waste pollution, which endangers its waterways, biodiversity, and communities. The ongoing Plastic Flow Mekong Project (March 2024 - May 2026) addresses this challenge through an innovative, multi-faceted approach that integrates cutting-edge technology, grassroots community engagement, and regional collaboration across four countries—Thailand, Cambodia, Vietnam, and Laos. As the project progresses, advanced plastic waste detection technologies, including AI-driven CCTV systems, are being deployed to monitor and map plastic leakage into the Mekong River and its tributaries. Additionally, the project leverages citizen science through a mobile app survey, empowering local communities to contribute to creating a plastic leakage map by identifying pollution hotspots. In parallel, the project is actively building capacity within local government agencies, focusing on the zero-waste concept, plastic circularity, and community-driven initiatives. Through workshops and training sessions, the project equips local stakeholders with the knowledge and tools necessary to implement sustainable waste management practices, fostering a culture of environmental stewardship. A key aspect of the Plastic Flow Mekong Project is its emphasis on regional collaboration, uniting diverse stakeholders across borders to share knowledge, align strategies, and amplify the impact of individual efforts. By intertwining technology, education, and collaboration, the project aims to address the immediate issue of plastic pollution while also laying the groundwork for a sustainable waste management framework in the Mekong Basin. This presentation will discuss the project's ongoing methodologies, preliminary outcomes, and anticipated impacts, offering insights that may serve as a blueprint for other regions facing similar environmental challenges.*

Keywords*: Plastic Pollution; Climate Change; Grass root Approach, Regional Collaboration.*

Tools and Protocols for Monitoring Plastic Pollution in Lower Mekong River Basin Countries: Status and Challenges

Sri Shalini Sathyanarayanan*, Achara Ussawaujikulchai, Narin Boontanon, Suwanna Kitpati Boontanon, Chettiyappan Visvanathan
Mahidol University, Salaya, Phuttamonthon, Nakhon Pathom, Thailand
**Corresponding Author: srishalini10@gmail.com*

ABSTRACT: *Plastic waste quantity of about eight million tons ends up in Lower Mekong River basin (LMB) from Cambodia, Thailand, Lao PDR and Vietnam every year. Effective monitoring of plastic pollution is imperative, as it is complex and relies on many factors. The present paper delivers various available tools and protocols for monitoring plastic pollution in LMB countries (Cambodia, Thailand, Lao PDR and Vietnam). It provides an overview of its implementation status, their effectiveness through identifying gaps and challenges and highlights best practices and recommendations for improving monitoring of plastic initiatives. Tools used for monitoring plastic pollution range from basic visual observation to advanced AI technologies. Common categories are using nets, pump systems, visual observation, passive sampling, aerial surveys and CCTV systems. These tools are guided by established international standards and tailored for regional contexts in accurately assessing the plastic pollution. Under Mekong River Commission (MRC) have protocols for monitoring riverine macroplastic, microplastic and microplastic in fish. The success stories of Biobars project in Cambodia, plastic monitoring activity at Chao Phraya River in Thailand, plastic monitoring using Remote Sensing in Vietnam and LaoPDR not only highlights the utilization efficacies of tools and community engagement in plastic monitoring, also showcases the limitations in implementing these tools. Establishing standardized protocols and reporting mechanisms for enhancement of more effective adoption of these tools across regions are vital. The way forward for institutionalizing riverine plastic pollution monitoring through potential integration or appending riverine plastic monitoring into country's existing Water Pollution/ Water Quality Monitoring activities.*

Keywords*: monitoring plastic pollution; lower Mekong River basin countries; tools and protocols; macro and micro plastics; community engagement.*

Enzymatic Degradation of Polycaprolactone (PCL) by Mycobacterium Marinum Cutinase: A Sustainable Approach to Plastic Waste Management

Jayashree Ravi, Preethi Ragunathan*
CAS in Crystallography and Biophysics, University of Madras, Chennai, India
**Corresponding Author: preeth_182003@yahoo.co.in*

ABSTRACT: *The excessive use and disposal of synthetic plastics have created a significant environmental crisis, particularly in marine ecosystems. To address this issue, we characterized the plastic-degrading enzyme cutinase from Mycobacterium marinum (Mm Cut3) and investigated its ability to degrade polycaprolactone (PCL), a synthetic aliphatic semi-crystalline polymer. The degradation rate of PCL can range from months to years, influenced by factors such as crystallinity, molecular weight, and environmental conditions. In this study, we explored PCL degradation by Mm Cut3 using zone clearance assays, Fourier-transform infrared spectroscopy (FT-IR) to monitor structural changes, and scanning electron microscopy (SEM) to assess surface morphology alterations of the polymer. For the first time, we applied the Langmuir kinetic model to analyze the biodegradation kinetics of PCL, providing novel insights into enzyme-polymer interactions. Additionally, molecular docking and dynamics simulations were employed to study the binding of cutinase to PCL, further elucidating the enzymatic degradation mechanism. Our findings demonstrate Mm Cut3 has significant potential for environmental applications, particularly in biodegradation of synthetic polymers. Future studies will focus on protein engineering to enhance the enzyme's substrate specificity and expand its activity towards a broader range of polymers, such as PET, PES, and PBS, paving the way for sustainable plastic waste management.*
Abbreviation: PET – Polyethylene terephthalate, PES – Polyethylene Succinate, PBS – Polybutylene Succinate.

Keywords*: Cutinase, Biodegradation, polycaprolactone (PCL), Kinetics.*

Microstructural Analysis of Plastic Waste Composite Construction Materials

Devansh Jain[1], Suresh Singh Kushwah[2], Harshita Jain[3,*]

[1]L.N. Malviya Infra Projects Pvt. Ltd., Bhopal, M.P., India
[2]Department of Civil Engineering; University Institute of Technology – Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal, M.P., India.
[3]Department of Computer Science & Engineering; University Institute of Technology – Rajiv Gandhi Proudyogiki Vishwavidyalaya Bhopal, M.P., India

**Corresponding Author: ssh.harshita@gmail.com*

ABSTRACT: *Plastic waste is increasing rapidly worldwide. Manufacturing construction material by using plastic waste is also an option for recycling plastic waste. This paper focuses on the study of the microstructural properties of the composite construction material made up of plastic waste along with coarse aggregate and fine aggregate in varying compositions. Plastic waste, i.e., high-density polyethylene (HDPE), low-density polyethylene (LDPE), and polyethylene terephthalate (PETE), are softened using used engine oil to make plastic composition construction material. For microstructural analysis, thermogravimetric analysis, differential scanning calorimeter, x-ray powder diffraction, scanning electron microscopy, and an energy dispersive x-ray test have been performed. The results show that manufactured material is stable, crystalline in nature, environmentally fit, and can be used for construction.*

Keywords*: Composite Construction Material, Recycling, Microstructural Analysis, Polyethylene, Plastic waste.*

Recycling Technologies for Sustainable Plastic Waste Management: Challenges and Opportunities

M. Jaya Soundraya Bharathi*

SRM Institute of Science and Technology, India

**Corresponding Author: jm8340@srmist.edu.in*

ABSTRACT: *The increasing global production of plastic, exceeding 359 million tons annually, has resulted in a significant environmental crisis, with approximately 72% ending up in landfills or natural ecosystems. This paper explores the various types of plastics, emphasizing their classification into thermoplastics and thermosetting polymers, and discusses the vital role of recycling in addressing plastic waste.*

Recycling can mitigate environmental challenges, but it faces substantial hurdles, including the diversity of plastic types, contamination, and economic constraints. We examine three primary recycling methods: mechanical, chemical, and thermal recycling, highlighting their advantages and limitations. Mechanical recycling is cost-effective but struggles with material quality and contamination. Chemical recycling, while capable of producing high-quality materials, is energy-intensive and often costly. Thermal recycling provides an avenue for generating fuels and chemicals but carries environmental risks. Furthermore, the paper discusses the challenges specific to plastic recycling in India, including insufficient infrastructure and public awareness.

It also analyzes the drawbacks of traditional plastic waste disposal methods, such as landfilling, which can lead to soil and water contamination, and the environmental impact of incineration. By addressing these multifaceted challenges, this paper aims to contribute to the development of sustainable plastic management practices and promote a circular economy that reduces reliance on virgin materials.

Keywords*:*

Enhanced Plastic Waste Sorting Using Multi-Sensor Fusion and Deep Learning for Improved Recycling Efficiency

S Thanga TamilSelvi*, Astangini Selvaraj, M K Kavitha Devi
CSE, Thiagarajar College of Engineering, India
**Corresponding Author: thangatamilselvicse@gmail.com*

ABSTRACT: *Plastic wastes in our day-to-day life leads to pollution in the environment. The pollution affects the ecosystems and human health. This impact can be reduced by recycling the plastic waste into a useful product. Plastics are broadly classified into six categories namely: PET (Polyethylene Terephthalate), HDPE (High-Density Polyethylene), PVC (Poly Vinyl Chloride), LDPE (Low-Density Polyethylene), PP (Poly Propylene), PS (Poly Styrene). The recycled product depends upon the type of plastics. The important process in recycling is sorting of plastics into different categories. Most of the sorting process is done manually, which is a time-consuming process, which leads to bottlenecks in the recycling process. To address the bottleneck, some automate the process by using machine learning algorithms for sorting. The challenge in the machine learning based sorting technique is extracting the useful features for high accuracy. To overcome the issues in the existing manual based and machine learning based approaches, the Convolutional neural networks (CNN) based sorting approach is proposed. In this paper, the inputs are plastic wastes images, which are initially pre-processed and then fed into the CNN model for classifying the waste into six categories. At the later stage, the optimizer is applied to reduce the loss error. Data are collected from publicly available datasets and are further augmented to improve the performance. The proposed system is evaluated based on Accuracy, Precision, Recall performance metrics. Experiments are conducted to prove the proposed system has high performance.*

Keywords*:*

Bio-Upcycling: Conversion of Plastic Waste into Valuable Products through Microorganisms

D. Sriveni*, P. Brahmaji Rao, K. James Abe Hillari
Department of Environmental Science, Acharya Nagarjuna University, India
**Corresponding Author: sriveni.dasireddy@gmail.com*

ABSTRACT: *A wide range of synthetic or semi-synthetic materials that are made of polymer as a main compound is plastic. More than 430 million tons of plastic are consumed in daily life and globally across various industries. Plastic can take up to 450 years to decompose; only 9 percent of plastic is recycled, and the remaining is discarded as waste ends up in landfills and in oceans. When large pieces of plastic waste are disposed of in the environment, they get weathered and degrade, posing significant environmental risks. To overcome the plastic-associated problems, Bio-upcycling offers a promising solution that is considered a more effective approach in the management and valuation of plastic waste. Bio-upcycling is closely related to the biodegradation of plastics, which involves the Enzymatic reactions produced by the microorganisms that can utilize plastic as their carbon source for growth (Lomwongsopon et.al). Manipulate the structure and functions of enzymes based on their characteristics by using biotechnological approaches for improving the stability of plastic degrading enzymes (Elahi et.al). Enzymes isolated from the microorganisms can split the polymers into monomers. This allows for the conversion of conventional plastic waste into valuable products such as biopolymers, biochemicals and biosurfactants. Bio-upcycling enhances the circular economy by converting conventional plastic into renewable, carbon-efficient chemicals and new polymers, or recycling monomers from bio depolymerization to maintain quality. Ultimately, this study aims to contribute to sustainable plastic waste management.*

Keywords*: Bio-upcycling, Microorganisms, Enzymes, Valuable Products, Circular economy.*

Enzyme-Driven Plastic Biodegradation: Harnessing Organismal Diversity for a Sustainable Future - A Comprehensive Review

Haritha Rajan, Amal R, Suja P Devipriya*
School of Environmental Studies, Cochin University of Science and Technology, Kochi, India
**Corresponding Author: devipriyasuja@gmail.com*

ABSTRACT: *Plastics, though indispensable to modern life, have become a significant environmental challenge due to their increasing production and the inefficiency of current waste management strategies, such as landfilling, incineration, and limited recycling. These conventional methods are inadequate in addressing the growing plastic pollution problem, leading to severe environmental consequences. The rising concern has sparked interest in bio-based and biodegradable plastics as alternatives for plastic waste treatment. Transitioning to a sustainable circular economy necessitates advancements in the biodegradation of both conventional and biodegradable plastics, which remain persistent in the environment. This review critically examines recent developments in enzyme-based biodegradation mechanisms for various plastics, including polyesters, polyamides, polyurethanes, and polyolefins. It explores how specific enzymes produced by prokaryotes and eukaryotes—such as bacteria, fungi, waxworms, and other insects—catalyse the breakdown of complex plastic polymers. Notably, a divide between terrestrial and aquatic species is highlighted, emphasizing how environmental context influences biodegradation. Additionally, the review underscores the synergistic effects where multiple enzymes work together to enhance degradation efficiency. For instance, hydrolases like PETases and cutinases effectively target polyester-based plastics, while laccases and peroxidases demonstrate efficiency against polyurethanes. By exploring the role, efficiency, and synergistic interactions of these enzymes in various microorganisms, this review presents enzyme-driven biodegradation as a promising solution to the global plastic waste crisis. Future research should focus on optimizing enzyme efficiency, expanding substrate specificity, and applying advanced biotechnological approaches to scale up these biocatalytic processes to industrial levels, thereby integrating enzyme-based technologies into existing waste management systems..*

Keywords*: Enzyme-based biodegradation; Plastic waste management; Polyester degradation; Microbial biocatalysis.*

A Study of Centralised and Decentralised Plastic Waste Management Models: Strategies and Practices of Kerala State

K.P.A. Fahmi, A. Shaija*, N. Baranwal
Mechanical Engineering Department, NIT Calicut, Kerala, India
**Corresponding Author: shaija@nitc.ac.in*

ABSTRACT: *Urbanization and industrialization make life easier; but it creates tons of waste, major part of it is plastic. A significant volume of waste produced in India, especially in coastal states is thrown out to sea during monsoons due to slope of geography and a large number of rivers. The Governments must adhere to strong waste management policies and regulations that can help to reduce global pollution. Kerala, the southern State of India has a long coast line which increases the dumping of mismanaged waste to ocean. Well trained waste collectors Haritha Karma Sena in the state collect and transfer the waste to material collection centers, recovery facilities etc. Kerala abide Central government's plastic waste management rule, 2016 (amendments). As per Kerala State Environment Plan 2022, State is planning for more efficient landfills and aims to be 100% renewable energy dependent State by 2050. Different missions e.g., Suchitwa Mission, Haritha Keralam Mission, and mandates like Green Protocol under each mission help to make Kerala clean. The objective of this study is to understand the strategies and practices adopted by Kerala State government in plastic waste management and compare with Indore which is the cleanest city of India for seven years in a row from 2017. Jagirdars collects and segregate waste in Indore and the municipal corporation work hard to maintain the status of cleanest city. This paper aims the study of the efficient technologies and its effectiveness and implementation possibilities in Kerala.*

Keywords*: Plastic waste management, Strategies, Practices, Cleanest city-Indore, Kerala.*

Green Synthesis of Silver Nanoparticles Embedded on Cocos Nucifera Coirs for Supercapacitors

Sudha G.[1], Ananda Babu S[1], Naidu Mahendran[1], Hisanth V[1], Samyukta P[2], Ganesh V.[2,*]

[1]Dept. of Chemical Engineering, Sri Venkateswara College of Engineering, Pennalur, India

2Dept. of Chemical Engineering, SRM Institute of Science and Technology, Kattankulathur, India

**Corresponding Author: gv1469@srmist.edu.in*

ABSTRACT: *Green synthesis of nanoparticles is an important area in the field of nanotechnology, which has cost effective and environmentally friendly benefit over physical and chemical methods. The present study shows In-situ synthesis of silver nanoparticles through green route using Cocos Nucifera Coir. Here silver nanoparticles are formed and subsequently they are coated on coir surface. The synthesized silver nanoparticles were characterized by SEM, EDX and TEM. From SEM and TEM analysis the formation of silver nanoparticles of size ranging between 5 to 50 nm has been proved. When the silver nanoparticle coated Cocos Nucifera Coir was used as a dielectric material it showed an enhancement in value of dielectric constant as compared to the untreated Cocos Nucifera Coir which is due to higher packing density of silver nanoparticles. These silver coated coir can be used as a dielectric material in embedded capacitor and exhibits a dielectric constant valve of 2.98.*

Keywords*: In-situ synthesis, Cocos Nucifera Coir, Dielectric material, Capacitor.*

Green Marketing Tools for Biodegradable Plastic Bags by using the 7P methodology

Jozsef Kovacs[*]

Innovation Management Doctoral School, University of Óbuda, 1034 Budapest, Bécsi út 96/B, Hungary

**Corresponding Author: kovacs.jozsef.hwd@gmail.com*

ABSTRACT: *During the examination of services it is impossible to ignore the increasing influence of "sustainability". This is especially true for plastic packaging materials, bags, and sacks. The aim of this document is to analyze, in a broader structured case study the possibility of replacing plastic packaging materials of green waste collection with compostable alternatives, addressing the green marketing strategy of the product in line with the 7P model. Although the Single Use Plastic (SUP) regulation imposes significant restrictions on single-use plastics, the microplastics still have a significant impact on the environment. Alternatively, the use of compostable green waste collection bags as innovative, alternative solution. This publication describes bioplastics and compostable plastics, their characteristics, problems and importance in waste management through structured case studies in Hungary. It defines for green marketing of compostable bags the examination of relevant challenges and opportunities. The horizontal marketing strategies, referring to the marketing mix or the 7Ps of green marketing to seize the sustainable opportunities, is the guarantee of the success of the sustainable transition. The growing scientific literature and media coverage of the health effects of microplastics is an opportunity for the degradable bag as a disruptive technology. According to my research, by changing communication from "degradable" to "microplastic-free", we essentially ride on an already existing wave and take advantage of an already existing strength.*

Keywords*: Compostable packaging, PLA, green marketing, 7P.*

The Process Lifecycle of Plastic Waste Management - A Study on Implications for Human Health

Sania Kukkar[1,*], Sheenam Gogia[2]

[1]SKD University, Rajasthan, India
[2]Jain University, Bangalore, India

**Corresponding Author: Sania.kukkar@gmail.com*

ABSTRACT: *An enormous amount of plastic waste has been produced by the widespread use of a variety of plastic products. It is necessary to raise knowledge of their applications and to include regular management into our way of life. Today, plastic is utilized more and more in our daily lives. Plastic is used in the packaging of various food and beverage businesses, as well as in the cosmetics, pharmaceutical, and other industrial sectors. These industries pack their final products to ensure that they are delivered to the public in a safe and effective manner. If it is not being properly handled and managed, it can have numerous negative effects on the people and environment. Although there are a number of techniques for managing plastic trash, the current approach is unsustainable, and the most popular method is still to dump plastic garbage in landfills. Plastic waste is non-biodegradable, thus throwing it in a landfill can have negative effects on the environment and public health. Numerous studies have been carried out to maintain the management of plastic waste and its consequences on the environment and human population. This research discusses the creation and management of plastic garbage, as well as the impact it has on the environment and on people. This study addresses sustainable waste management practices as well as the main obstacles to implementing practical solutions to reduce the harmful effects of plastic trash. Furthermore, the different approaches of managing plastic waste and their advantages for the environment have been examined.*

Keywords*: Environment, Plastic, Plastic Management, Reuse, Recycling.*

Assessment of Ocean Plastic on the Beaches of Visakhapatnam, Andhra Pradesh

Siddharth Palla[1], Manoj Rayaroth[1], Harish Prakash[1*], Subhash Chandran[2]

[1]Department of Life Sciences, GITAM School of Science, GITAM (Deemed to be) University, India
[2]Platypus Escapes Private Limited, Rushikonda, Visakhapatnam, India

**Corresponding Author: hprakash@gitam.edu*

ABSTRACT: *Ocean trash, especially plastic, is one of the major sources of marine pollution, requiring urgent waste management solutions worldwide. Many aquatic organisms get killed by entangling and/or ingesting the plastic trash from the ocean. Plastic also gets broken down into micro or even nano plastic by biotic and abiotic factors, eventually accumulating in the ecosystem. Around 30 million tonnes of plastic is estimated to be littered in the oceans, an additional 1.7 million tonnes of plastic gets transported into the ocean every year, and about ~88% of the plastic is found floating on the shoreline (OECD Global Plastics Outlook 2022) and eventually litters the beach. The need of the hour is to prevent plastic trash from ending up in the ocean and find a solution to remove the ones that get washed ashore. We study how much ocean trash gets washed ashore along the coast of Visakhapatnam, Andhra Pradesh and investigate how trash varies in quantity across different beach sites. Additionally, we examine the nature of the collected trash and explore if it can be segregated into various categories that can be reused, recycled, or repurposed for economic benefit. Based on the segregation, we also plan to study in the lab how different plastic materials degrade over time if left in the ocean and what parameters critically affect the weathering of plastics. In summary, we hope to measure the magnitude of the city's trash problem and find possible solutions to reduce its environmental impact.*

Keywords*:*

Awareness, Attitudes, Values and Attributional Dispositions of Plastic usage and Disposal

S. Srividya*

Department of Clinical Psychology, School of Allied and Health Care Sciences, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India

**Corresponding Author: email.srividya@gmail.com*

ABSTRACT: *Plastic usage and disposal require active engagement by all the stakeholders-the Government, producer and seller of the non-bio degradable plastics, and the consumer himself. Though steps have been taken in this regard, the questions remains whether the steps have taken have made a change in the awareness, attitudes, and values in the perception of the non-bio degradable plastics. The present study has conceptualized a model to evaluate Awareness, Attitudes, Values and Attributional Dispositions to examine the Self-efficacy of the user. The study was conducted among a sample of 1200 individuals in a varied demographic background. A conceptual framework in analytical terms was developed and regression analysis was done to examine the factors using Confirmatory Factor Analysis. The results showed that Awareness about the ill effects of plastics does not help to overcome Learned Inability because usage of plastics is an outgrowth of growing consumerist life style and has become inevitable. Awareness (on the ill effects of plastics) has weak relationship with Attitude (towards plastic usage and disposal). The result signifies that though knowledge on ill effects of plastics in environment exists, a participatory mechanism involving all the stakeholders of plastics should be focussed in future environmental decision-making policy. The model also showed that relationship between Attitude towards plastic usage and disposal is the strongest predictor of Learned Inability. Thus, to reduce Learned Inability, collective action needs to be encouraged and the only way can be through the process of empowerment.*

Keywords*: Awareness, Attitudes, Values, Attributional Dispositions, Learned Inability.*

Exploring Financing Mechanisms for Plastic Waste Management in Asia Pacific Region

Chettiyappan Visvanathan*, Humm Kham Zan Zan Aung, Suwanna Kitpati Boontanon

Department of Civil and Environmental Engineering, Faculty of Engineering, Mahidol University, Salaya, Phuttamonthon, Nakhon Pathom, Thailand

**Corresponding Author: visuvaru@gmail.com*

ABSTRACT: *This presentation provides a comprehensive overview of the diverse financial mechanisms and strategies being utilized to address the accelerating plastic pollution problem in the APAC region. It explores into the roles of key multilateral institutions such as the World Bank, Asian Development Bank (ADB), and the Global Environment Facility (GEF), which have established various trust funds, frameworks, and projects aimed at mitigating plastic pollution. It also highlights bilateral funding sources from countries like Sweden, Norway, Australia, and Japan, which support a range of initiatives from policy development to capacity building and awareness campaigns. Private sector investments, including those from impact investors, multinational corporations, and philanthropic organizations like the Ellen MacArthur Foundation and Circulate Capital, are also discussed, underscoring their contributions to both downstream (recycling and waste management) and upstream (reuse and refill) solutions. However, it identifies significant gaps in financing, particularly in upstream solutions, with most investments still focused on downstream activities. This imbalance is further worsened by the instability of investments in the region, as highlighted by the Plastics Circularity Investment Tracker. The presentation calls for enhanced collaboration between governments, development partners, and the private sector to strengthen existing initiatives, avoid duplication, and maximize the impact of financial resources. In conclusion, the presentation discusses the potential for a global plastic treaty to create a dedicated fund or financing mechanism that could help bridge the current financing gaps, particularly in regions like APAC where plastic pollution is most severe. The need for innovative financing modalities and stronger partnerships is emphasized as crucial for making substantial progress in the fight against plastic pollution in the region.*

Pyrolysis of Single use Plastics in Bangladesh – Technical Performance Review of the Scarabtech Mark III Beetle Unit

Dellwar Hossain*, Michael Poustie, Fariduzzman Shapon
Practical Action in Bangladesh, Bangladesh
**Corresponding Author: dellwer.hossain@practicalaction.org.bd*

ABSTRACT: *Purpose: Single use, soft plastics pose a management challenge in urban Bangladesh. There are no viable markets that encourage the collection, transport and recycling of these plastics in secondary towns.*

Unmanaged soft plastics cause significant costs and disruption to municipalities and urban communities – blocked drains cause urban flooding and open burning causes air pollution and lung disease. Practical Action has been assessing the technical performance of chemical recycling (pyrolysis) of single use plastics into a fuel grade (diesel) oil product and black carbon. Pyrolysis is viewed as an interim solution while the country implements their plastic reduction strategies. Well managed and monitored pyrolysis offers better environmental outcomes than current practices of open burning, dumpsite burning or disposing plastics into waterways.

Method: In 2023, following a global review of pyrolysis model performance, Practical Action imported a ScarabTech Mark III Beetle Pyrolysis Unit from South Africa to the secondary town of Faridpur. The plant was officially opened in March 2024, and has produced more than 2000L of saleable fuel oil. Performance data has been collected throughout the past 6 months of operation including:

- *Rates of production (per hour and max production per day)*
- *Quality of fuel products – including independent laboratory testing*
- *Performance with differing feedstock qualities and components*
- *Performance with and without pre-feed plastic agglomerator*

Results: The ScarabTech unit can produce a high-quality fuel oil which meets local market demand. However, the low density of shredded, dried soft-plastic significantly decreases efficacy with pre-feed agglomeration essential. Initial challenges included a lower-than-expected production rate. Limited initially to150kg of plastic feedstock per day. However, including a mixture of soft plastic and high-density plastic, and altering the ratio of soft plastic-to-high density plastic has improved performance and production rates. Full numerical results and analysis will be presented.

Implications: Pyrolysis of single use soft plastic technically performs adequately to offer an interim management step. However, improving production rates to 400 kg per day of plastic feedstock will increase business viability.

Keywords*: Single Use Plastics, Chemical Recycling, Pyrolysis, Bangladesh, Performance Review.*

Business Performance of a Pilot Pyrolysis Unit in Faridpur, Bangladesh: Pathways to a Viable Circular Economy?

Fariduzzman Shapon*, Sirajus Salekin, Michael Poustie
Practical Action in Bangladesh, Bangladesh
**Corresponding Author: fariduzzaman.shapon@practicalaction.org.bd*

ABSTRACT: *Purpose: Plastic waste in Bangladesh poses significant challenges and opportunities within a circular economy framework. The pyrolysis of single use plastics is one possible pathway for the establishment of a circular economy for single use plastics. Pyrolysis units in Bangladesh could generate jobs, conserve resources, and reduce reliance on fossil fuels. It presents an opportunity to formalize the informal waste collection sector. Practical Action has a long history of designing human-centered, business driven interventions, that improve the lives and livelihoods of vulnerable and excluded sectors of society. Achieving business viability for plastic pyrolysis however, requires removing barriers such as limited public awareness, insufficient infrastructure, and inadequate government support.*
Method: Practical Action established a pilot scale system in Faridpur. Supporting the entire system required to support plastic pyrolysis as a pathway to circular economy for plastics without a current market value. The system included:
(i) formalizing waste-workers collecting and segregating suitable single use plastics;
(ii) establishing the pre-treatment processes needed to ensure quality feedstock;
(iii) the pyrolysis of the plastic to produce fuel-grade oil; and
(iv) the sale of pyrolytic oil to the local markets.
8 months' data on the collection and purchasing of waste plastics, the performance of the pyrolysis unit and ongoing sale of the fuel-grade oil have been collected.
Results: The presentation will include all the data on the business viability up until now – all income and expenses of the system. The performance of the first 6 months suggested a non-viable business performance. However, learning from this, new components were introduced. New income streams (plastic credits) and reducing the operating costs (reduced purchasing of feedstock) are both increasing business viability.
Implications: Viable pyrolysis business models for single use plastic waste are challenging but not impossible if the correct regulatory and incentive schemes are present.

Keywords*: Business model, Circular Economy, Plastic, Innovation, Market Linkages.*

Building a Sustainable Future: Transforming Plastic Waste into Ecobricks

Saveo Biju Joseph, S.N Kumar, Sreeja C*, Bellarmine Xavier
Amal Jyothi College of Engineering, Kerala, India
**Corresponding Author: csreeja@amaljyothi.ac.in*

ABSTRACT: *The Plastic-Based Ecobrick Manufacturing System converts waste plastic into sustainable construction materials. This process includes the systematic collection and sorting of plastic waste, shredding, mixing the shredded plastic precisely with cement and M-Sand, compacting in brick moulds, and curing to achieve high strength and durability. This strength in the implementation of ecobricks serves as a resilient, environmental alternative to traditional brick manufacture where plastic waste is transformed into value resources. Not only will it solve the pressing issue of plastic pollution but rather supports a sustainable and circular economy in building practices. In the brick construction, 3 samples with various replacement percentage of plastic were made and compressive Strength test on the 28th day revealed promising results The compressive strength was carried out using the Universal Testing Machine, it was found that up to 3% replacement of fine aggregate with shredded plastic, the compressive strength of the eco brick exceeded the minimum requirement specified by the Bureau of Indian Standards (BIS), which is 3.5 N/mm2.*

Keywords*: Plastic waste recycling, Sustainable construction, Universal Testing Machine (UTM), Bureau of Indian Standards (BIS)*

Transforming Plastic Waste into Economic Value: Business Viability and Circular Economy Opportunities in Bangladesh's Recycling Sector

Sirajus Salekin*, Fariduzzman Shapon
Practical Action in Bangladesh, Bangladesh
**Corresponding Author: Sirajus.Salekin@practicalaction.org.bd*

ABSTRACT: *Purpose: Plastic waste management in Bangladesh poses significant challenges and opportunities within a circular economy framework. The country generates approximately 87,000 tonnes of plastic waste per year (World Bank, 2021). Of this, only 36% is currently recycled, while the remaining 64% ends up in landfills, water bodies, or is openly burned (DoE, 2023). Transforming plastic waste into a resource could generate an estimated 50,000 new jobs (ILO, 2023), with a potential market value of 700 million annually (ADB, 2023). However, achieving this profitability depends on beneficial regulations, sustainable production systems, and a viable market for recycled products. However, achieving this profitability depends on beneficial regulations and policies, sustainable production systems, and a viable market for recycled products. Chemical recycling methods, especially pyrolysis, offer promising pathways to produce valuable outputs like fuel oil from plastic waste. Design: For the last 3 years Practical Action has been working on a pilot project for plastic pyrolysis in the secondary city of Faridpur. Through this experience, Practical Action is well placed to share about the way that existing policies, regulations and enabling environment both opportunities that incentivize the sector, and presentalso the hurdles that business need to be overcome to be viable long-term solutions. Findings: Opportunities that incentivise plastic recycling businesses include: (i) new financing products are available that support environment-friendly green and sustainable ventures; and (ii) plastic credits are an emerging tool, incentivising private sector investment, and providing additional income streams to recycling project. Existing barriers that will be highlighted include: (i) weak policy frameworks, (ii) limited recycling infrastructure; (iii) limited public awareness, and (iv) difficulties in receiving required certification and government approvals. Implications: Establishing a circular economy for plastic waste in Bangladesh will require coordinated efforts among government entities, private enterprises, and communities. Addressing these bottlenecks offers Bangladesh to transform plastic waste into economic value, support sustainable development, and progress towards a greener future. Originality: This research is the first time an overview of the enabling environment for chemical recycling of single use plastics from a Bangladeshi context is presented.*

Keywords*: Policy and regulations, business model, Circular Economy, plastic waste recycling Business model, Circular Economy, Plastic, Innovation, Market Linkages.*

Plastic pollution and waste recycling and repurposing during and after COVID19: potential energy and environmental implications.

Sibusiso Ngxingo, Roman Tandlich*
Disaster Management and Ethics Research Group (DMERG), Rhodes University
**Corresponding Author: r.tandlich@ru.ac.za*

ABSTRACT: *Plastic waste is at the core of the COVID19 pandemic, as there have been the need to provide personal protective equipment to healthcare workers. At the same time, there were extended lockdowns for the populations of national states. The purchasing of basic necessities of life was studied as a potential source of plastic waste. A set of purchases during the harshest lockdowns in South Africa as conducted by the study team as a way to only use one-use plastic bags to carry the everyday purchased items. Both authors individually purchased the items in local grocery stores and collected the plastic bags. These were then used to construct ecobricks which would be filled with the one-use plastic bags until the ecobrick was full. Then it was subjected to thermal expansion studies, the porosity measurements, and density measurements. Implications for the ecobrick measurements and the policy in using ecobrick production as a building material and waste reduction method will be discussed and analysed in the current presentation.*

Keywords*:*

Developing a market for recycled plastic credits to promote the implementation of extended producer responsibility (EPR) in Vietnam

Nguyễn Thi
Department of law, Hanoi University of Natural Resources and Environment
**Corresponding Author: nthi@outlook.com.*

ABSTRACT: *Vietnam's plastics industry has grown at an average rate of 15-20% annually. Per capita plastic consumption increased from 3.8 kg per person per year in 1990 to 52 kg per person per year in 2023, with approximately 50% being single-use plastics. The country generates about 1.8 million tons of plastic waste annually, but only around 27% is collected and recycled, with most of the remainder being landfilled or incinerated. This suggests that the amount of plastic waste in Vietnam will surge in the coming years.State regulations on plastic waste management are still developing and implementation remains inconsistent, especially for volume-based waste fees, Extended Producer Responsibility (EPR), and measures to limit or ban plastic use and promote a circular economy. These policies, designed to leverage financial incentives to encourage compliance, have primarily focused on increasing collection and recycling rates, lacking effective solutions for recycled plastic consumption. This imbalance could undermine the growth of the recycling market.Globally, many countries have mandated the use of recycled plastics in products and packaging, and companies have actively committed to such practices. In Vietnam, the Prime Minister has instructed the Ministry of Industry and Trade to establish regulations on the use of recycled plastics in products and packaging. Consequently, a market for trading recycled plastics is emerging. Therefore, developing a market for recycled plastics is essential to help manufacturers meet mandatory recycled content targets, encourage higher usage rates in industries, promote collection and recycling processes, reduce plastic leakage into the environment, and curb the overuse of virgin plastics. This approach is also an effective policy for companies to fulfill EPR requirements in Vietnam.*

Ethical implications and modelling estimates of the plastic waste estimation in a South African municipality.

Chidinma Iheanetu, Rene Oosthuizen, Roman Tandlich*
Disaster Management and Ethics Research Group (DMERG), Rhodes University
**Corresponding Author: r.tandlich@ru.ac.za.*

ABSTRACT: *As a result of the increase in waste generation caused by population increase and technological advancement, the problem of solid waste management has become a compounding problem and difficult to solve. In recent times, there has been an increase in environmental degradation resulting in the problem of climate change, public health and general safety concerns, and the unavailability of more and more land to use as landfill sites. Managing this Solid waste is influenced by various factors, ranging from socio-economic consideration to technological advancement and environmental concerns. Waste generation and management practices in a community are influenced by its socioeconomic background. While lower-income areas might struggle with insufficient services, wealthier areas might have more resources to invest in effective waste management systems. Furthermore, there are differences in public education and awareness regarding waste management techniques, which can affect community involvement in recycling and waste reduction programs. Having a clear understanding of how this problem originates will go a long way toward fostering a long-lasting solution. This will be handled using evolutionary ethics principles. This method, according to Darwin theory, uses the understanding of how species evolve to help us understand human behaviour, survival and reproductive success. In this work, the use of evolutionary ethics as a solid waste management methodological framework is investigated. We suggest a novel strategy that highlights how human behavior is adaptive in response to environmental challenges by fusing ethical considerations with the ideas of evolutionary theory. The study looks at how evolutionary ethics can improve community involvement in waste management programs, encourage sustainable practices, and inform decision-making processes. We demonstrate how evolutionary ethics can promote a better comprehension of the moral ramifications of waste generation and disposal through a thorough examination of case studies and empirical data. The goal of this research is to help create more ethically sound and efficient solid waste management techniques that prioritize social. Responsibility and ecological integrity. Evolutionary ethics uses a collaborative and participatory approach, which brings about a longterm solution to the management of solid waste. This will help policymakers and practitioners to develop a more effective strategy for promoting a more sociable and environmentally sustainable approach to solid waste management.*

Recycling of plastics derived from electronic waste using irradiation processes

Rachida Khadidja BENMAMMAR[1], Zohra BOUBERKA[2], Christian MALAS[3], Venkateswara Rao MUNDLAPATI[4], Ana BARRERA1, Jean-Noël STAELENS[1], Yvain CARPENTIER[4], Michael ZISKIND[4], Cristian FOCSA[4] Philippe SUPIOT[1], Corinne FOISSAC[1], Ulrich MASCHKE[1,*]

[1]Unité Matériaux et Transformations (UMET), UMR 8207, CNRS, INRAE, Université de Lille, France
[2]Laboratoire Physico-chimique des Matériaux, Catalyse et Environnement (LPMCE), Algeria
[3]Institut Chevreul, CNRS, INRAE, Université de Lille, France
[4]Physique des Lasers Atomes et Molécules (PhLAM), UMR 8523, CNRS, Université de Lille, France
**Corresponding Author: ulrich.maschke@univ-lille.fr*

ABSTRACT: *The decontamination of model systems of industrial polymers containing a brominated flame retardant (BFR) was investigated through the utilization of electron beam (EB) and ultraviolet (UV)-visible irradiation processes. In this report, two types of polymers, namely Acrylo-Butadiene-Styrene (ABS) and PolyCarbonate (PC), which are predominantly found in Waste Electrical and Electronic Equipment (WEEE), were subjected to irradiation via both electron beam (EB) and ultraviolet (UV) processes with the objective of degrading DecaBromoDiphenylEther (DBDE), which is regarded as one of the most toxic brominated flame retardants (BFRs).The analysis conducted using Fourier Transform Infrared spectroscopy demonstrated that the degradation percentage of DBDE was in excess of 85% for the ABS-DBDE system and 90% for the PC-DBDE system, irrespective of the irradiation technique employed. Thermal analysis by differential scanning calorimetry (DSC) demonstrated the existence of cross-linking effects and slight alterations in the glass transition temperatures for ABS and PC following irradiation processing. Thermogravimetric analysis demonstrated that the polymers retained their thermal stability following irradiation. High-resolution mass spectroscopy substantiated the debromination of the ABS-DBDE and PC-DBDE systems. Consequently, the obtained results are promising and may represent an alternative solution for the removal of bromine and other additives from plastics found in WEEE.*

Keywords*:*

A Deep Learning Model to Recognize and Classify Plastic Waste

Ipsita Saha[1,*], Amit Kundu[2], Sadhan Kumar Ghosh[3]

[1]Guru Nanak Institute of Technology, India
[2]North-Eastern Hill University, Meghalaya, India
[3]International Society of Waste Management, Air and Water, India
**Corresponding Author: ipsita.saha49*

ABSTRACT: *The management of plastic waste is a global concern. Scientists develop research automated sorting techniques to improve recycling efficiency because manual rubbish sorting is a costly and challenging operation. Artificial intelligence, particularly deep learning, and image processing techniques can be used to enhance the recycling process by autonomously selecting plastic for waste collection on a transmission belt. Paper, plastic, metal, and glass are among the main material classes to which waste segregation techniques and procedures are applied. Sorting different types of materials together, such different colors of glass or different types of plastic, is the most difficult task. Because only some forms of plastic may be recycled (PET can be turned into polyester), the problem of plastic waste is significant. As a result, we ought to find methods for sorting this debris. Using convolutional neural networks and deep learning like VGG 19, Resnet 50 on plastic waste dataset, different components of plastic i.e. polyethylene, polypropylene, and polystyrene can be categorized. In this paper an automatic plastic waste segregation method has been suggested that can separate trash into the different categories. This method of plastic trash recognition and segregation might be used in a sorting facility or at a citizen's home..*

Keywords*: Plastic Waste, Deep Learning, Convolutional Neural Networks, Plastic Trash Recognition, Segregation*

Pricing Transparency in the Recycled Plastics Supply Chain in India, Indonesia, Thailand, and Vietnam

Juline Lew*
Policy Advocacy Research Centre
**Corresponding Author: jlew@thecirculateinitiative.org*

ABSTRACT: *Recycled plastics markets in India and Southeast Asia face multiple demand- and supply-linked bottlenecks along the value chain, including a lack of transparency in the pricing of plastic waste feedstock and recycled plastics. This opacity results in fluctuating demand and supply, poor capacity utilization at recycling facilities, and, ultimately, challenges for brand owners to meet commitments on using recycled content in plastic packaging. Data on prices is critical for strategic planning at all levels. In the absence of pricing data, brands and other buyers of recycled plastics set targets that are out of sync with market realities. This presentation will provide key insights from a 2023 study by The Circulate Initiative, "Pricing Transparency in the Recycled Plastics Supply Chain in India, Indonesia, Thailand, and Vietnam" (https://www.thecirculateinitiative.org/recycled-plastics-prices-and-policy-tool). and will discuss pricing in the recycled plastics value chains in the four geographies, as well as provide an overview of the modelled impacts of selected policy interventions on improving pricing transparency.*

Keywords*:*

Nano-Enabled Biocatalysts for Enhanced Biodegradation Of Plastic Waste

K. James Abe Hillari*, P. Brahmaji Rao, D. Sriveni
Dept. of Environmental Sciences, Acharya Nagarjuna University, A.P
**Corresponding Author: jamesabehillari3@gmail.com*

ABSTRACT: *Plastics are widely used in today's world due to their durability, lightweight, and low cost, leading to significant waste generation. Despite the availability of various disposal and degradation methods, most are not sustainable, with only around 10% of plastic waste being recycled. This study aims to develop nano-enabled biocatalysts by integrating nanotechnology with microbial consortia to enhance plastic biodegradation. Nanoparticles such as metal oxides or carbon-based materials will act as carriers for specialized microbial communities (J Singh et.al) that can degrade specific plastics and also promote their growth and metabolic processes. The distinct properties of nanoparticles will enhance microbial enzymatic activity, accelerating plastic degradation into environmentally safe and beneficial substances. Previous work in nano-enabled biocatalysts application for plastic degradation is limited. This research addresses global plastic pollution through integrated and innovative biotechnological solutions, combining nanotechnology with microbial capabilities for more effective waste management. Key steps involve selecting suitable nanoparticles and optimizing microbial systems to ensure effective plastic breakdown using enzymes like PETase (Wei Feng et.al). This technology represents an exciting frontier in environmental biotechnology, offering significant potential for bioremediation, waste treatment, and environmental cleanup. It aims to create an eco-friendly economy and promote a sustainable approach where plastics are efficiently recycled or degraded. The integration of nano-enabled biocatalysts in plastic degradation enhances strategies for managing plastic pollution. However, further research is needed to fully unlock the potential of this technology within global waste management systems.*

Keywords*: Microorganisms, Nanoparticles, Nano-enabled biocatalysts, PETase, Sustainable economy.*

A Plastic Credit financed based approach to waste management: A Case Study of Malappuram District in Kerala

Raghuvir Raghav Das*
India
**Corresponding Author: raghuvirdas@alumni.nls.ac.in*

ABSTRACT: *Plastic waste management is a challenge across Indian communities with few avenues for municipalities to finance the required infrastructure and networks despite extensive EPR Regulations for plastic waste. However some unique models are emerging across urban local bodies across states in India. A case study approach is utilised to demonstrate the value chains involved in the implementation of plastic credit based financing for villages under Malappuram district of Kerala, India. Based on the on ground survey work and experiences captured in 2021, a qualitative case study approach is used in this study to describe the actors including the local stakeholders such as the village level urban local body, the waste management firm Green Worms , local community members such as the village level governing body, the village level women led waste collectors under the "Harit Karm Sena"(Green Army), residents and local businesses is mapped out to demonstrate the role and importance of adequate financing for a circular economy approach to plastic waste management. It is intended to demonstrate how plastic credits lead to a high level of accountability, transparency and clear impact on the ground such as payments for services rendered by the Women Led Waste Collectors, the enhanced plastic waste recovery and recycling and the infrastructure financed under plastic credits set up by Green Worms.*

Keywords*:*

3SR – Green station toward net zero for Vietnam through waste management

BUI Thi Thanh Huong*
3SR VNU Spin off, Vietnam National University, Hanoi, Vietnam
**Corresponding Author: bui.thanh.huong.vn@gmail.com*

ABSTRACT: *3SR – Green station, the distinctive circular economy model in Vietnam National University, Hanoi, Vietnam, through carbon and plastic credits towards Net zero in Vietnam. Leveraging VNU's strengths in science, technology, and its reputable brand, VNU Greentech unites scientists and dynamic young individuals passionate about the 3SR project—Smart Retail, Smart Refill, Smart Recycling. Smart retail vending machines can hold up to 300 products and come equipped with free Wi-Fi. Payment options include QR codes, cash, RFID cards, or NFC features on mobile devices. 3SR collaborates with retail suppliers whose products meet green consumption standards. 3SR has partnered with Fuji Electric Group (Japan) to provide thousands of vending machines, key hardware components of the supply chain managed by software developed by VNU scientists. Integrating Smart Refill with the vending system is one of 3SR's innovative features. This approach introduces a new trend in the liquid supply chain, reducing plastic packaging waste and supporting producers in fulfilling their extended responsibilities during this significant green transformation The automatic weighing stations help customers quantify waste. Customers swipe RFID cards or use the NFC feature on their phones before sorting and weighing waste. The system records and transfers points and accumulated funds to the card if customers sort waste into the following categories: food waste, paper waste, fabric waste, batteries and electronics, flexible plastics, hard plastics, plastic bottles, and glass. Customers can use the accumulated balance on their cards to purchase goods within the 3SR system. What's remarkable is that 3SR provides real-time monitoring and reporting on the accumulation of carbon and plastic credits for localities, regions, and nations. This data serves as a crucial foundation for developing action plans aimed at achieving Vietnam's NETZERO target by 2050.*

Keywords*: waste sort, green station, plastic credit, carbon credit, smart refill, smart recycling, smart retails, 3SR.*

Effective Strategies for Plastic Waste Management in Municipal Solid Waste Systems

Maruwada Srinivasan[1,*], Ramprasad Naik Desavathu[1], Rakesh Roshan Dash[2], Raghvendra Sahu[1]

[1]Dept. of Civil Engineering, Gandhi Institute of Engineering and Technology University, Gunupur, Odisha, India
[2]Dept. of Civil Engineering, VSSUT Burla, Sambalpur, Odisha, India

**Corresponding Author: srinivasan.maruwada@giet.edu*

ABSTRACT: *The biochemical process of polymerization, in which monomers like ethylene, propylene, and styrene chemically link to form lengthy polymer chains, is how plastics are made. Plastics are widely employed in a variety of industries, such as packaging, cosmetics, and pharmaceuticals, because of their adaptability, durability, and low weight. But the widespread use of plastic products has raised serious questions about plastic waste and its effects on the environment.*

Pollution from plastic garbage is a worldwide problem that impacts marine habitats, water bodies, and land. The majority of plastic garbage is difficult to break down, which causes long-term environmental issues. Plastic waste can pollute food and water sources, injure wildlife, and upset ecosystems. Because they can enter the food chain and be consumed by marine organisms, microplastics in particular constitute a serious hazard to human and animal health.

Educating people on the proper handling and usage of plastics is crucial to addressing this problem. Reducing the usage of single-use plastics, supporting recycling programs, and fostering the creation of biodegradable substitutes should be the main goals. To reduce plastic trash and lessen its negative environmental effects, businesses and consumers alike must embrace sustainable methods.

From polymerization or polycondensation during production until their ultimate disposal as waste, plastic products go through several stages in their existence. Plastic garbage can have a lot of negative effects on the environment if it is not properly treated and controlled. The lifecycle of various plastic product types, such as polyvinyl chloride (PVC–U), polystyrene (PS), polypropylene (PP), high-density polyethylene (HDPE), polyethylene terephthalate (PETE), and others, is examined in this article. The study draws attention to the environmental issues—such as air pollution, soil and water contamination, and microplastic pollution—caused by the improper processing and handling of plastic trash. The review also explores possible ways to overcome these obstacles, stressing the value of recycling, biodegradable plastics, and sustainable waste management techniques. Future generations will live in a better planet if these steps are taken to lessen the negative effects of plastic waste on the environment and to minimize the causes of climate change.

Keywords*: Plastic wastes, Thermoplastics Polymerization, Recycling Waste management Bioremediation*

XVI.
Policy

Life Cycle Inventories of Techniques in Marble Processing Industries of Rajasthan

Dharmanshu Singh Sodha[1], Harlal Singh Mali[2], Amit Singh[3,*]

[1]Mechanical Engineering Department, M.L.V. Textile and Engineering College, Bhilwara, India

[2]Mechanical Engineering Department, MNIT, Jaipur, India

[3]Mechanical Engineering Department, NIT, Calicut, India

**Corresponding Author: amitsingh@nit.ac.in*

ABSTRACT: *In order to enhance the sustainability of the industry that processes dimensional marble stones, the dimensional stone sector is becoming more engaged in the sustainable development of the latest solutions. The Life Cycle Assessment (LCA) is a widely acknowledged quantitative methodology used to quantify the environmental impacts of operations. Nevertheless, the scarcity of relevant Life Cycle Inventory (LCI) datasets for each processing technique poses a challenge for conducting LCA in the dimensional stone industry. The LCA is a widely acknowledged quantitative methodology used to quantify the environmental impacts of operations. Nevertheless, the scarcity of LCI datasets for specific processes poses a challenge for conducting LCA in the dimensional stone industry. This paper presents LCI datasets for the prevalent and widely used processing techniques used in the processing of marble stones. In order to achieve this objective, data was gathered directly from Rajasthan (India) marble processing plants and companies involved in the production of processing machines. The datasets achieve high replicability and flexibility as all the datasets is corresponding to each processing technique and in 1ft2 of marble stone. The Ecoinvent pedigree matrix procedure was also used to determine the uncertainty level in the resulting LCI datasets. The presented datasets helps in the expansion of life cycle databases of processing techniques which leads to improvement of the fundamental parts of sustainability in the marble processing industry.*

Keywords*: Sustainability, Marble Processing Industry, Processing Techniques, Life cycle Inventory.*

Sustainable Entrepreneurship in Mizoram: Harnessing MSME Policies and Government Schemes to Boost the Beekeeping Sector

Monu Singh[1,*], Meera Peethambaran[1], Noopur[2], Jhansi Rani B[2]

1Dept. Of Human Resource Management & Organizational Development, Gitam School of Business, Hyderabad Campus, Hyderabad, India

2Dept. of Accounting and Finance, GSB, Hyderabad, India

**Corresponding Author: msingh4@gitam.edu*

ABSTRACT: *The Indian MSME sector sustains and improves entrepreneurs' lives, predominantly through the promotion of sustainable business practices. Under the Honourable Prime Minister Shri Narendra Modi, the Ministry of Micro, Small, and Medium Enterprises (MSME) has implemented many initiatives, programs, and policies to promote entrepreneurship nationwide through innovative and sustainable business strategies .However, Indian MSMEs face many challenges. It must adopt innovative and sustainable business strategies to overcome these challenges. The objectives of the study are- First, to understand what is apiculture activity and apiculture as a sustainable entrepreneur. Second, to study the Indian Govt. schemes and initiatives to promote apiculture as a sustainable entrepreneur and the case of SMT. Hmanjaihkim from Mizoram state of India. For this study, the researchers have used the Mixed study method. The study found that the STRY-based training program, implemented by the Agricultural Technology Management Agency (ATMA) in the Siaha District of Mizoram, in collaboration with SAMETI in Aizawl and MANAGE in Hyderabad, helped participants learn the skills and knowledge needed to identify significant implications follow this phenomenon. She promotes beekeeping, cross-pollination, and hive products like honey. Use of readily available natural resources in beekeeping for aspiring and established entrepreneurs.*

Keywords*: MSME, Entrepreneurs, Government policies and schemes, Bee- Keeping, Training.*

Risks and Challenges in Adopting Sustainable Geotechnical Techniques in Kerala's Lateritic Soil

Shruthi Johnson*
India
**Corresponding Author: shruthipereira@gmail.com*

ABSTRACT: *In Kerala, the use of sustainable geotechnical techniques is becoming more and more important*
due to the state's distinct topographical constraints, declining resources, and growing environmental concerns. A major obstacle to the effective application of these techniques is Kerala's lateritic soil, which is noted for its vulnerability to erosion and landslides during the monsoon season. Sustainable practices, which reduce land degradation, conserve natural resources, and support land-use stability, have long-term and positive effects on the environment, although they frequently face many challenges. The most urgent issues are the high price of sustainable materials, the difficulty of accessibility, and the political resistance that regularly causes project delays or disruptions. The acceptance of these strategies is further hampered by social resistance, which is fuelled by ignorance of and doubt about their effectiveness. Furthermore, there are questions regarding the environmental compatibility of sustainable geotechnical methods in Kerala's fragile ecosystems because to the intricate relationship between the two, especially in areas with a variety of flora and fauna. An extensive analysis of the various hazards connected to the implementation of sustainable geotechnical methods in Kerala is presented in this research, with particular attention to the effects on the environment, political dynamics, and socioeconomic consequences. Only a thorough investigation of previously published works and news articles is used to conduct the review, which provides insights into practical applications, public opinion, and policy difficulties. This work highlights major obstacles to the wider adoption of sustainable geotechnical solutions, suggests possible corrective actions, and draws on case examples and academic analysis from the past few years. In order to guarantee these methods work in Kerala's complex and changing landscape, special emphasis is made on incorporating biodiversity preservation, and climate resilience into them.

On the Systems Thinking Approach to Science and Engineering Education at Gandhi Institute of Technology and Management

Atanu Bhattacharya*
GITAM School of Science, Gandhi Institute of Technology and Management, Visakhapatnam, India
**Corresponding Author: abhattac3@gitam.edu*

ABSTRACT: *History of mankind has witnessed that Universities play an important role in social reformation, scientific innovation and technological advancement. In general, universities offer education in diverse categorized fields following a reductionist approach. For example, science division offers education in physics, chemistry, biology, environmental science, etc. Engineering division offers education in computer engineering, civil engineering, mechanical engineering, electrical engineering, etc. It has been strongly argued in recent education literature that 21st century's sustainable challenges (as defined by the United Nations' Sustainability Development Goals)1 cannot be solved using the compartmentalized education system.2 Rather systems thinking (ST) approach is needed. Researchers and educators around the globe have started exploring ST approach to better equip next generation citizens for 21st century's sustainable challenges. Thus far, little is known about implementation techniques of ST approach in Indian education system. India is known for its all around diversity (language, culture, economy, technology, etc.). It is exceedingly important that Indian educators start exploring ST approaches in its University education system to take active part in solving global sustainable challenges. With the above-mentioned goal in mind, I have been exploring implementation techniques of ST in science and engineering classrooms at Gandhi Institute of Technology and Management (Visakhapatnam). The present contribution will discuss the ST approaches we have taken up and students' perspectives and experiences of ST approaches that involve discussion of circular economy, frugal design and cradle-to-grave analysis in science and engineering class rooms. Case studies will be presented to illustrate how ST is being implemented, how it is appreciated by students, and how thinking of the theme of the present conference can be initiated in the science and engineering classrooms.*

Role of Banks in Enabling Circular Economy

Sushma Kaza[1,*], Divya Kirti Gupta[2]

[1]Dept. of Business Economics, Gitam School of Business, Gitam University, India

[2]Dept. of HR, Gitam School of Business, Gitam University, India

**Corresponding Author: skaza@gitam.edu*

ABSTRACT: *Purpose: Banks are uniquely positioned to enable a circular economy, because of their pivotal role as purveyors of financial services. They can impact in two ways: 1) Indirectly by moderating their loan exposure to polluting sectors/industries. Banks have kept abreast of the trends, and slowly moving away to renewable energy financing and 2) Directly by minimizing their own carbon footprint. 1) Banks can play a catalytic role in changing consumer behavior, by promoting green deposits, loans, mortgages, and cards among others. However, banks are facing public outlash over using retail deposits to fund polluting industries. Since the Paris Agreement, between 2016 - 2023, the world's 60 largest private banks financed fossil fuels with USD $6.9 trillion, with U.S. banks such as JPMorgan Chase, Citi, Bank of America, Wells Fargo, Goldman Sachs, and Morgan Stanley accounting for over $1.8 trillion. In sharp contrast, around 25 biggest European banks, reduced their oil and gas sector loan exposure by over 50% from $106b in 2020 to $55b in 2021. These include HSBC, Barclays, and BNP Paribas, among others. Further, in UAE, HSBC is offering green mortgage loans at flexible terms to environment friendly properties. 2) In the case of own CO2 emissions, Barclays reduced 86% greenhouse gas (GHG) emissions and shifted to 94% renewable electricity model. Bank data centers account for 91% of their total power consumption, which can be reduced by shifting to cloud computing.*
Design/methodology/approach: For this paper, we will analyze cross-sectional data from the ESG reports of select US, European and Indian banks, respectively. Focus will also be on early leaders promoting sustainable banking practices. The period of study is 2019-2023 (5 years), The sample size is 15-20 banks. We will study: 1) Trend analysis in timeseries data of loans advanced to polluting industries/sectors 2) Sustainable revenue trends 2) CO2 emissions and carbon footprint trends of the individual bank and 3) Suggest an action plan framework to enhance bank role in promoting a circular economy.
Originality/value: Banks needs to adopt a three-dimensional approach a) action b) measure and c) disclosure to assess the impact of their activities on climate sustainability. This is the suggested action plan framework for banks.

Keywords*: Banks and circular economy, banks green initiatives, green financial services and products, sustainable lending, banks climate action framework.*

The Role of Sustainable Waste Management and Circular Economy in Achieving Global Environmental Goals

Ravi Jayaram*

India

**Corresponding Author*: ravijayaram999@gmail.com

ABSTRACT: *This paper explores the critical role of sustainable waste management and the circular economy in addressing global environmental challenges such as resource depletion, pollution, and climate change. Focusing on the key themes from the International Conference on Sustainable Waste Management and Circular Economy & IPLA Global Forum 2024, the paper highlights innovative solutions for achieving a net zero economy through waste reduction, sustainable packaging, and advanced recycling technologies. It also examines the importance of policy frameworks, eco-design, and Industry 4.0 technologies in fostering a circular economy, alongside the role of social entrepreneurship and frugal innovation in developing scalable, cost-effective waste management solutions. By connecting these concepts to global environmental goals, the paper emphasizes the need for international cooperation, regulatory cohesion, and industry innovation to drive the transition toward a more sustainable future.*

Keywords*:*

Effects of Socio-Economic Climate Change: Indian Environmental Policy Issues

Mohd Sadiq Ali Khan[1,*], Swaleha Parveen[2]
Sanskriti University Mathura, U.P., India
Department of Political Science, Aligarh Muslim University, Aligarh, India
**Corresponding Author: Msghauri786@gmail.com*

ABSTRACT: *Climate change is a "large, global, long-term, cumulative, and unknown challenge," according to the Stern report from 2007. Being the major environmental issue that humanity will face over the coming millennia, climate change has received a lot of press. This new all-encompassing social risk has been characterised as posing a "really difficult and diabolical policy dilemma." The well-being of present and future populations, both born and unborn, is threatened by its effects, which are not only global but also intergenerational. The most important problems affecting civilization now include climate change. These will bring about hard to measure benefits in terms of avoiding climate change further in the future. As climate change is a global phenomenon, it is not a single economy or group of economies that can solve this problem. To plan for the future and create policies that will address climate change and global warming, the nation requires accurate climate projections. This study explores governments must actively participate in changing people's perceptions of their interests in order to sustain stable societal majorities in support of implementing mitigation and adaptation policy regime. Climate change is predicted to have a considerable impact on freshwater availability, soil productivity, and human settlement patterns. In essence, we can state that the effects of climate change could be complex.*

Keywords*: Climate change, Sustainable development, Green Technology, Environmental and socio-economic issues, climate-resilient development.*

Practice Oriented Waste Management Education – A Way to Futuristic Sustainable Environment

Sivapriya Chellappa[*], S Subhashini
Jnana Vikas Jagrati, Chennai, India
**Corresponding Author: jvikasjconsultancy@gmail.com*

ABSTRACT: *In the age of Sustainable Development Goals, Waste Management is a critical element to achieve a sustainable environment and better public health. As per a new United Nations Environment Programme (UNEP) report, the municipal waste is expected to increase by two thirds along with a doubling cost. Today, we need innovative strategies to enhance the understanding of every individual from his early growing days towards refuse, recycle & reduce wastes. This necessitates a practical action-based curriculum in educational institutions to achieve our Sustainable Development Goals. Strengthening the youth engagement towards waste management from an early stage can positively impact our futuristic goals on waste management. We need to raise the interest & make the optimal waste management as a habit among the learners through the educational institutions. This can slowly influence the future attitude of the learner towards minimising the wastes which is a global issue. The current research paper identifies the gaps in implementing a sustainable waste management practice in the educational institutions and also highlights on the various strategies that can be used to improve the concerned areas.*

Keywords*: Education, Waste Management Practices, Habit, Attitude, Strategies.*

Climate Finance Cost Benefit Analysis towards Sustainable Finance Development: A Comparative Study of Various National Policies

G.V.K. Kasthuri*

Department of Finance, Gitam School of Business, Gitam Deemed to be University, Visakhpatnam, Andhra Pradesh, India

**Corresponding Author:*

ABSTRACT: *A key component of climate finance is the global integrated energy system, which generates capital for both the public and private sectors. This results in large-scale investment in sustainable finance. Specific guidelines for international funds with varying duties for climate change and renewable energy sources are outlined in the Paris Agreement and the Green Climate Funds global fundraising aims to raise at least $100 billion a year to support climate bonds, especially for wealthy and developing nations. This conference paper discusses the various countries' current policies and recommendations for improved fundraising to obtain benefits such as project-based financing. The necessity of climate finance for industrial units of all sizes is covered in the first section. Second, it discusses the laws put in place by various countries to support this kind of fundraising. Thirdly, it discusses the tax breaks and incentives that certain nations provide, which may serve as a signal to other nations regarding the accomplishment of specific firm objectives and the advancement of their economies. It is stated that calculating the cost-benefit analysis of these funds turns into a topic of education for the general public or possible investors about the sustainable and economic growth.*

Keywords*: Climate finance, sustainable finance, green bonds, renewable energy, sustainable development, climate funds, global funds.*

Waste Governance in the Nairobi City County Government in Kenya

Michael K. Koech*, Kaburu J. Munene, Mary K. Kinoti, Magdalene Kagendo

Kenyatta University, Nairobi, Kenya

**Corresponding Author: mi.koech@yahoo.com/ mi.koech@gmail.com*

ABSTRACT: *Kenya's population is steadily growing, with over 47 million people, according to the 2019 census statistics. Additionally, the number of urban centers in the country has also increased significantly. Population and urbanization are exacerbating the waste crisis across most urban areas and hinterlands in Kenya. Nairobi is the most populous city, with the Kenya Institute for Public Policy Research and Analysis stating that its population is approximately 5.4 million. Nairobi produces considerably large amounts of diverse wastes that mainly end up in open dumpsites, posing environmental and health risks. Poor collection and segregation, limited recycling and composting efforts, limited public awareness and community involvement, insufficient implementation of environmental laws and policies, as well as limited public-private partnerships are just some of the challenges impeding Kenya's urban areas' transition to a circular economy. However, the Circular Economy concept presents a promising environmental and economic opportunity in an urbanizing world. Circular Economy upholds green economy, industrial ecology, and eco-design principles, contributing to the reduction of ecological and carbon footprint in the entire production cycle. A holistic transition to the circularity agenda by urban areas, institutions, and other relevant actors must be grounded in an enabling policy environment. Therefore, this paper explores existing circular economy policy priorities within Kenya's administrative capital, Nairobi City County.*

Keywords*: Policy, Circular Economy, Diverse wastes, environmental laws, Kenya.*

AI-based Waste Classification for Restaurants in Vietnam

Nguyen Xuan Huy[1], Ngo Thi Thao[2], Ngoc Thanh Thuy Nguyen[3], Nguyen Hanh Thao Quynh[4], Nguyen Tan Phat[5], Lien T.K. Trinh[6,*]

[1]International College, Ming Chuan University, Taipei, Taiwan
[2]Faculty of Education, Da Lat University, Da Lat, Vietnam
[3]Økologihaven Rosborg Denmark - Brændekildevej 43, Bellinge, Denmark
[4]Economics Department, Dongnai University, Dong Nai, Vietnam
[5]Viet Au High School, Hochiminh city, Vietnam
[6]Institute of Environmental Engineering and Management, National Taipei University of Technology, Taipei, Taiwan

**Corresponding Author: kimlienmtk36@gmail.com*

ABSTRACT: *In Vietnam, restaurant waste primarily consists of food remains, plastic waste from bottles and straws, glass bottles, aluminum cans, and napkins. Waste sorting significantly enhances recycling, thereby minimizing its impact on the environment. This work implemented a restaurant-based approach to waste sorting by providing five separate bins for different types of waste: food, plastics, glass, aluminum, and others. Plastic, glass, and aluminum waste were collected bi-weekly on Mondays by a local recycling company, while food waste was composted using enzymes to produce organic fertilizer for the restaurant's vegetable farm. Other types of waste were collected daily by local waste management services. To improve sorting accuracy, each waste bin had a tablet providing clear instructions on proper waste sorting. The languages used were Vietnamese, English, and Chinese. Additionally, a sensor attached to the bin's opening alerted customers when improperly sorted waste was detected. Furthermore, when any bin reached 90% capacity, an automatic alert notified the restaurant's waste management team to ensure timely collection. In addition, the software included an AI Chabot to answer questions and assist customers with waste management and sorting knowledge. The software also featured mini-games for children to enjoy while waiting for their meals. Furthermore, the data collected on the amount of waste, types, and frequency of collections were automatically compiled by the system for analysis and forecasting, allowing for the development of appropriate solutions. The research is currently in the implementation and pilot phase, and the results are expected to significantly address the problem of waste classification in restaurants, ensuring hygiene and environmental protection. The integration of AI technology in this waste management initiative aims to promote environmentally sustainable practices within restaurants while educating customers about proper waste disposal.*

Keywords*: Waste Sorting, Recycling, AI Technology, Composting, Environmental Protection.*

Government's Role in driving ESG Performance: The Indian Context

K.Bhavana*, Atmakuri Vamsi Krushna, Radha Raghuramapatruni

Gitam deemed to be University, India

**Corresponding Author: bkomma2@gitam.in*

ABSTRACT: *For businesses and investors, investing in environmental, social, and governance (ESG) factors has seen significant growth in both India and globally. Nevertheless, governments have not kept pace. The central, state, and local governments in India must comprehend the significance of ESG to boost sustainable development. The study's objectives are to examine : 1) the relationship between ESG and governmental responsibilities to safeguard individuals and the environment; 2) The extent to which the government should regulate ESG disclosure, performance, or ratings; 3) The strategies governments might employ to attract capital to their region, taking into account the interests of investors; 4) The influence of ESG ratings on a government's credit rating and financing capacity, as well as the identification of feasible, advisable, and problematic actions overall. The paper's findings reveal that the government can enhance ESG output by: 1) Promoting robust and uniform ESG reporting across companies, sectors, industries, and government departments, as well as across various levels of government, thereby providing all stakeholders with a common language and framework; 2) Enhancing ESG performance through data and policy to incentivize good performance, attract investors and stakeholders, and convey robust signals regarding ongoing improvement. 3) Ensuring the accessibility of relevant ESG data and information to interested parties, as well as providing clarity and establishing regulations that increase investor trust and attract additional investment.*

Climate Risk in Financial Markets: A Natural Experiment on Kyoto Protocol Commitments

Komapalli Sasi Kumar, Chandrabhanu Das*
GITAM School of Business, Hyderabad Campus, GITAM Deemed to be University, India
**Corresponding Author: cdas@gitam.edu*

ABSTRACT: *Purpose: Globalization and technological advancements have increased information spillover in financial markets. Studies have discussed extensively how stock markets react to different news or events. However, fewer studies have addressed how stock market returns are influenced by information on climate risk. Therefore, this study aims to fill this gap by exploring the effects of climate risk on select equity markets.*
Design/methodology/approach: The study compares countries between the BASIC group countries (Brazil, South Africa, India, and China) and countries that did not participate in the Kyoto Protocol, which commits countries to reduce their emissions level. Applying the network connectedness approach, the study sheds light on the impact of climate risk on these countries' stock markets. The climate policy uncertainty index, constructed based on news on uncertainties related to climate policy, is taken as a proxy for climate risk in this study.
Findings: Findings reveal the association between climate risk information and stock markets. The effect of climate policy uncertainty for BASIC countries is higher than for countries that did not agree with the Kyoto Protocol. Further patterns find investor's interest in the clean energy market. Financial market integration was stronger for countries non-compliant with the Kyoto Protocol than for BASIC countries.
Implications: Our findings hold great implications for investors and policymakers to mitigate the effects of climate risk through effective regulatory and technological interventions. Further, the study provides specific information on portfolio diversification towards clean energy investment.
Originality/value: The paper extends the prior literature on cross-country analysis of climate management by quantifying various climate risk shocks in financial markets. The paper adopts a novel approach to estimate the extent of shocks from information on climate risk and their effect on return spillover in equity markets.

Keywords*: Climate policy, return spillover, Kyoto Protocol, financial markets.*

Circular Economy and Employment Opportunities in Indian Railways: Potential and Future Directions

Padala Veera Venkata Satyanarayana*, D. Surya Chandra Rao, Ch. Jayasankara Prasad, Sravani Maddala
Krishna University, Machilipatnam, India
**Corresponding Author: satyanarayanapadala17@gmail.com*

ABSTRACT: *The Circular Economy (CE) approach is pivotal in transitioning towards a sustainable economy by promoting resource efficiency, waste reduction, and the reuse of materials. This paper explores the relationship between CE practices and employment opportunities, with a focus on the manufacturing sector in general and in Indian Railways in particular. Through a literature review and survey through questionnaire in Indian Railways, this study highlights the potential of CE in creating jobs, and other potential social and market benefits. The study highlights the over all potential of circular practices integrated with Indian Railways procurement of goods for ensuring long-term sustainability of Indian Railways. Furthermore, the paper creates road map to Net Zero 2070 in Indian Railways. This paper underscores the significant employment opportunities that CE can generate and emphasizes the need for future research to develop innovative models to estimate the employment potential. Finally, the paper concludes with the conceptual model indicating the factors associated with job creation and highlights the implications for Indian Railway stakeholders.*

Keywords*: Circular economy, Employment opportunities, Net Zero 2070.*

Circular Economy Model and its Impact on Corporate Practices

Pragati Shukla*, Anees Mohammad
Faculty of Management Studies, University of Lucknow, India
**Corresponding Author: Pragati99942@gmail.com*

ABSTRACT: *tainability refers to the ability to maintain or support an environmental friendly process continuously over time. In business and policy contexts, sustainability seeks to prevent the depletion of natural or physical resources, so that the same is available for the long term in future. Our industrial economy has been dominated for the past 150 years by a linear model of production and consumption, where products are produced, sold, used, and then thrown away as waste. In the face of increasing global population, escalating resource consumption and environmental consequences, it is becoming increasingly evident that using a linear model is inappropriate for a sustainable future of consumption. The circular economy model is a preferable alternate option for the problem. The main aim of present research paper is exploring the significant potential of the circular economy model in transforming corporate sustainability practices. The circular economy emphasizes resource efficiency, waste reduction and the continuous reuse of materials. Through a comprehensive review this paper assess how companies like IKEA, Thousand Fell, Dye Coo, Winnow, Miniwiz, have incorporated circular economy principles into their business operations, leading to innovation and minimized environmental impact. This paper highlights the benefits of adopting circular strategies, including enhanced resource efficiency, cost saving and increased brand value. With the combination of few case studies and analysis of available literature, this researchers aim to provide a comprehensive understanding of how circular economy model can serve long term environmental sustainability.*

Keywords*: Sustainability, Circular economy, Linear economy, Process, Resources.*

Nexus of Air Pollution, Climate Change and Health: Open Waste Burning and Policy Gaps in Asia

Lakshitha Chathuranga Paranagamage*, Miho Hayashi, Premakumara Jagath Dickella Gamaralalage, Bimastyaji Surya Ramadan
CCET, Institute for Global Environmental Strategies, Kanagawa, Japan
**Corresponding Author: paranagamage@iges.or.jp*

ABSTRACT: *Open waste burning is a prevalent waste management practice in many parts of Asia, contributing significantly to air pollution and undermining efforts towards climate mitigation. This process releases harmful pollutants, including short-lived climate pollutants (SLCPs) such as black carbon and particulate matter (PM). These emissions exacerbate global warming and have severe health impacts, especially in densely populated regions. Poor waste management practices, particularly in low- and middle-income countries, lead to uncontrolled burning of municipal solid waste, releasing toxins that can trigger respiratory diseases, cardiovascular problems, and premature deaths. The Asian region, as one of the most populous continents, faces unique challenges in managing its growing waste problem. This issue is a critical driver of air pollution. Effective strategies to mitigate these emissions are essential to reducing both local health impacts and global climate consequences. SLCPs, including black carbon, are potent contributors to climate change, and controlling them can provide near-term climate benefits and improve air quality. Addressing the root causes of open waste burning through regulatory frameworks, improved waste management systems and sustainable infrastructure development is crucial. The strategies targeting the sources of pollution mitigate environmental degradation, safeguard public health, and reduce immediate threats posed by SLCPs. This paper examines the nexus of waste management, pollution control, and health, with a focus on policy gaps in Asia.*

Keywords*: Open waste burning, Black carbon, Air pollution, SLCPs, Health impacts.*

Compostable Bags as Disruptive Technology in Green Waste Collection of Hungary

Jozsef Kovacs*

Innovation Management Doctoral School, University of Óbuda, 1034 Budapest, Bécsi út 96/B, Hungary

**Corresponding Author: kovacs.jozsef.hwd@gmail.com*

ABSTRACT: *The introduction of the quartz watch in the 1970s. Presentation of the production car. What they have in common is the disruptive innovation. A business theory by Clayton M. Christensen, a disruptive innovation is an innovation that creates a new market or goes to the bottom of an existing market and eventually displaces established market leading companies and products focusing on replacing the plastic bags used in green waste collection with a compostable alternative. Would that be "disturbing" enough, if the green collection bag is composted within 12 weeks and leaves no microplastics behind? This article summarizes Christensen's principles that incumbents should address in green waste utilization and at the same time, it defines the potentially disruptive technology of compostable bags, which may affect the future Hungarian waste collection system, which faces many challenges in the future. The increasing volume of green materials, technological development, collection and utilization infrastructure and cost reduction are key factors, highlighting the reduction of microplastics in compost. This paper demonstrates the potential of disruptive technologies by emphasizing product innovation in organic waste treatment. Innovation, on the other hand, should provide high-value products, such as microplastic-free compost, for example, to return organic matter back into the earth's geochemical cycle.*

Keywords*: compostable plastics, disruptive technologies, microplastic, compost.*

Circular Economy Strategies in India: Evaluating Government Efforts for Environmental Sustainability

Rithika Jayabharathi Yuvarajan[1,*], Radhika K P[2]

[1]Department of Production Engineering, PSG College of Technology, Coimbatore, India
[2]Department of Humanities, PSG College of Technology, Coimbatore, India

**Corresponding Author: 23p126@psgtech.ac.in*

ABSTRACT: *This paper explores the potential of the circular economy (CE) as a regenerative economic system that prioritizes reducing waste and enhancing resource efficiency through practices such as reuse, repair, and recycling. Positioned as an alternative to the traditional linear economic model, the CE offers a pathway to sustainable growth by aligning with the United Nations' Sustainable Development Goals (SDGs). As noted by Shalini Goyal Bhalla, "Sustainable development is the pathway to the future we want for all" (UN, 2015). If India continues on its current linear trajectory, it risks missing an opportunity to adopt a regenerative development path that promotes long-term prosperity (Goyal & Bhalla, 2020). Globally, CE is increasingly recognized as a solution to pressing environmental and economic challenges by decoupling growth from resource consumption, fostering innovation, reducing waste, and supporting environmental resilience (Geissdoerfer et al., 2018). In India, where rapid urbanization and industrialization pose significant environmental challenges, adopting CE principles is crucial for sustainable development. A report by the Ellen MacArthur Foundation (2021) highlights that transitioning to a CE could generate $624 billion in economic benefits for India by 2030. In this context, the Indian government has initiated key policies aimed at advancing CE, enhancing resource efficiency, and mitigating environmental impact. This study critically examines two major initiatives—the Swachh Bharat Mission and the Jal Jeevan Mission—to assess their effectiveness in promoting CE principles. Secondary data from government publications and reports from organizations like the World Bank (2020) and NITI Aayog (2019) will be utilized to evaluate the successes and challenges of these policies in advancing sustainability. The findings provide insights into the impact of these initiatives on achieving SDGs, highlighting areas for improvement and suggesting avenues for policy enhancement to further India's progress towards a circular economy.*

Keywords*: Circular Economy, Government Policies, Swachh Bharat Mission, Jal Jeevan Mission.*

Sustainable Manufacturing in Industry 4.0 and 5.0

D. Adithya Kumar[1,*], Balaram Bora[2], P.Sree Devi[3]

[1]JNTU-Gurajada (JNTU-GV), Viziyanagaram, A.P, India
[2]Department of MBA, Aditya Institute of Technology & Management (AITAM), Tekkali, Srikakulam Dist, A.P, India
[3]JNTU-GV College of Engineering, Viziyanagaram, A.P, India
**Corresponding Author: vimpadithya@gmail.com*

ABSTRACT: *Purpose: In this light, the study examines sustainable manufacturing under Industry 4.0 and/or Industry 5.0 settings alongside evolving implications from cutting-edge digital technologies compared with human-centric innovation-environmental sustainability arrangements of earlier research work 2. Undeniably, there is a significant requirement to embrace sustainability in manufacturing industry as other production sectors come under increasing pressure to become more environmentally friendly. While Industry 4.0 is all about digital transformation and automation, Industry 5.0 underlines the cooperation between human and smart systems not only to balance production but also optimise every bit of resource used for such processes in a sustainable way possible.*
Design/methodology/approach: This study is an original contribution focusing on the integration of sustainable practices with Industry 4.0 and 5. In addition, this paper assesses the influence of leading technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI), Robotics/ with Big Data Analytics on Sustainable Manufacturing end results. There is impetus to the changes in production efficiency, reduction of waste and energy usage as well environmental impact. The synthesis categorizes secondary literature, and results from case studies are used to empirically determine the role of these technologies and human-centered design in contributing toward long-term sustainability goals.
Findings: The research suggests, for example, that the adoption of Industry 5.0 will allow industries to innovate sustainable practices; among other potential benefits are real-time monitoring and automation in optimizing resource usage as well waste reduction provided via industry using Industry 4. Advanced analytics give manufacturers more valuable insights to use for continuous improvement and the collaboration aspect of Industry 5.0 supports ethically-led, responsible production that also has less environmental impact as a result.
Implications: For practical implications, the empirical results highlight strategic ways how policy-makers can employ eco-innovation in integrating sustainability requirements with industrial development and suggest tactics for both manufacturers and technology developers. These are the aspects organisations must address, both in terms of technological upgrade but also in adjusting their workforce to ensure long-term sustainable results.
Originality/value: The contribution of this paper is that it connects concepts around Industry 4.0 and 5.0 with sustainable manufacturing, outlining a broader perspective on how the digitalization trends can complement human-centric advancements to serve environmental aspirations met goals. reduce greenhouse gas emissions. Taking advanced technology and sustainable aspect into consideration synergistically, this research delivers practical tips on how companies can comply with the standards of global sustainability in manufacturing.

Keywords*: Sustainable manufacturing, Industry 4.0, Industry 5.0, Human-machine collaboration, Environmental sustainability, Advanced digital technologies, Resource optimization.*

Smart contract Solutions for Pharmaceutical Waste Compliance - A Blockchain-based Approach

Niyati Vadaga*, Veera Babu Ramakurthi
School of Business, GITAM University, Hyderabad, Telangana, India
**Corresponding Author: nvadaga@gitam.in*

ABSTRACT: *We're changing the world with technology. Likewise, the pharmaceutical industry faces new challenges due to advancements in drug discovery and distribution, particularly in dealing with garbage from drug products. This is one of the serious environmental issues which cannot be treated like other waste compounds. From recycling IV Bags and Tubing to disposing of Cytotoxic Drugs and Antineoplastics, they need to be treated with caution to guarantee protection of the environment and adherence to rules. It's difficult for companies to meet stringent compliance criteria due to inefficiency in compound handling, which means that their current methods for managing and disposing of wastes are often insufficient. Smart contracts are self-executing codes on blockchain technology, providing an influential remedy for these problems, such as overseeing pharmaceutical waste disposal, verifying handling procedures, scheduling and automating compliance reporting. This work proposes a new method for managing waste in the pharmaceutical supply chain using blockchain-based smart contracts. Using this method, the process shall be transparent and tracing of disposal and recycling can be achieved. By automating compliance, blockchain can help create a sustainable pharmaceutical waste management framework. By integrating this technology, the pharmaceutical sector can increase public trust in its commitment and promote more responsible waste management practices.*

Keywords*: Blockchain Technology, Pharmaceuticals, Smart Contracts, Drug Disposal, Compound Handling.*

Experimental analysis of different biomass briquette composition and its application in steam process industry using pulsating grate boiler

Vaibhav Bode, Shyam Kodape*
Dept. of Chemical Engineering, Visvesvaraya National Institute of Technology, Maharashtra, India
**Corresponding Author: smkodape@che.vnit.ac.in*

ABSTRACT: *Solid fuel combination of briquette from biomass materials has gained considerable attention as sustainable replacement source of energy. Biomass briquettes for utilization as energy source for domestic and industrial steam heating Processes with required pressure and temperature. The energy obtain from biomass is especially useful for steam application through process boiler. This paper is aimed to summarize the key properties of solid briquette made from various natural and waste-based resources, and to highlight the steam process application in industrial area with the help of pulsating grate biomass fired composite boiler. The characteristics of briquette are imperative to ensure its effectiveness as fuel in a long run, use of different biomass briquette composition in process boiler to improve the combustion & evaporation rate of boiler which then helps to cater the steam requirement to process industry. This research work conducted to determine the different briquette composition calorific value, moisture, ash content of biomass briquette produced from Soyabean/sawdust/groundnut/pellets with their fix % by weight mixtures with the help of experimental setup like bomb calorimeter, muffle furnace and moisture analyser. All this different composition assessed in pulsating grate boiler. Results from different tests combination of briquettes show that the boiler combustion effectiveness with desired steam energy pressure which fulfils the requirement of industry with effective environmental factor.*

Keywords*: Biomass, Briquettes, Agro-residues, Calorific value, pulsating grate Boiler.*

A Bibliometric review on operational management tools and methodologies from industry 1.0 to industry 5.0 to improve patient-centric clinical trials

Prasanna Kumar C S*, Saisree Mangu

GITAM, School of Business, Bengaluru, India

**Corresponding Author: gagan.jain@woxsen.edu.in*

ABSTRACT: *This bibliometric review investigates the evolution of operational management tools and methodologies employed in clinical trials, tracing their development across the eras of industrial revolution from Industry 1.0 to Industry 5.0. The review analyses the impact of technological advancements and digitalization on patient-centricity within clinical trial operations. The study utilizes a comprehensive database of published research, focusing on key themes such as data management, process automation, artificial intelligence, and remote monitoring. The findings reveal a significant shift towards patient-centric approaches in clinical trial design and execution, driven by the adoption of Industry 5.0 technologies. The review highlights the use of advanced analytics, predictive modelling, and real-time data monitoring to enhance trial efficiency and improve patient experiences. Furthermore, the analysis explores the ethical implications of utilizing these technologies and emphasizes the need for robust frameworks to ensure data privacy and security. This review contributes to the existing literature by providing a comprehensive overview of the evolving landscape of operational management in clinical trials, identifying key trends and future research directions. The review identifies key trends, challenges, and future directions for operational management in clinical trials, with a particular focus on the role of Industry 5.0 in fostering patient empowerment and collaboration in the research process. This research provides valuable insights for stakeholders involved in clinical trial design, execution, and analysis, including pharmaceutical companies, research institutions, and regulatory bodies in advancing patient-centricity within the clinical trial ecosystem.*

Keywords*: Operation management, Patient-centric, Latest technologies, data analytics, Industrial evolution.*

Co-creation in sustainable waste management for urban built environment: A systematic review

Tusar Kanti Roy[1], Prasenjeet Sarkar Anik[1], Md. Khalid Hossain[1], Adiat Rahman[1], Kazi Salehin Mahmud[1], Sutripta Sarkar[2], Sadhan Kumar Ghosh[3]

[1]Department of Urban and Regional Planning, Khulna University of Engineering & Technology (KUET), Khulna, Bangladesh
[2]Department of Food and Nutrition, Barrackpore Rastraguru Surendranath College, Kolkata, India
[3]International Society of Waste Management, Air and Water, Kolkata, India

**Corresponding Author: tusarkroy@urp.kuet.ac.bd*

ABSTRACT: *In most urban areas, particularly in the rapidly emerging countries, solid waste management has emerged as a significant issue and difficulty. Despite various waste management policies and technologies, many cities struggle with effective and sustainable waste solutions. Bangladesh is generally faced with the rapid deterioration of environmental and sanitation conditions due to the conventional system of collection, transportation and the crude dumping of municipal solid waste (MSW). Therefore, urban solid waste management has become a major concern for cities and towns in the country. A lack of integration between stakeholders, including local communities, government, and private sector, limits the potential of sustainable waste management in urban built environments. This paper aims to explore the idea of co-creation in urban waste management by analyzing how stakeholder collaboration might improve the sustainability and effectiveness of waste management techniques in urban settings and finding strategies that encourage involvement and shared accountability among all parties involved in the waste management system. Research on co-creation and sustainable waste management techniques in urban environments is compiled in a thorough assessment of the literature. In a comprehensive review of the literature, studies on co-creation and sustainable waste management practices in urban settings are collected and assessed using a thematic analysis. In a tentative way the study finds out the strategies to connect co-creation and sustainable waste management encouraging more public involvement, waste reduction, and resource efficiency. The analysis focuses on effective case studies where rates of recycling are raised and landfill waste is decreased as a result of participatory methods. The analysis also highlights the importance of continuous involvement and education in maintaining co-creation projects, offering a road map for using comparable strategies in various urban settings.*

Keywords*: Co-creation, Solid waste management, Urban built environment, Stakeholder collaboration, Participatory approach.*

Identifying and Classifying the Problems and Defects in cross passage construction

A. Santhosh, B. Vijaya*, A. Hemamalinie, M. Harinath
M.G.R. Educational & Research Institute, Chennai, India
**Corresponding Author: santhoshanbu258@gmail.com*

ABSTRACT: *The construction of cross passages is essential to improving underground infrastructure's accessibility and safety, especially in metropolitan locations. The intricacies of this type of construction, however, can result in several issues and flaws that might affect its structural integrity and operational effectiveness. The purpose of this study is to categorize and identify the typical problems that arise during the construction of cross passages. These problems include structural problems, geotechnical difficulties, water management issues, material shortages, construction defects, safety risks, environmental factors, and operational shortcomings. This research enables a thorough understanding of potential risks related to cross passage construction by using a systematic classification technique based on severity, kind, location, and origin. The results highlight the significance of proactive maintenance programs, efficient remedial techniques, and routine monitoring in reducing the detected problems. In the end, this study promotes the durability of underground infrastructure by improving safety standards and operational reliability in cross passage construction works by providing a clear framework for problem identification and classification.*

Keywords*: TBM Tunnelling, Cross passage.*

A study on the impact of improper coal loading in coal supply chain

Syam Naga Kumar Pydi*, Y L P Thorani
GITAM School of Business, Operations & Supply Chain, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: syampydi@gmail.com*

ABSTRACT: *The coal industry plays a crucial role in the global energy landscape, providing a major share of the energy needs. Coal supply chain is multifaceted and complex with various stages and stakeholders involved. Despite getting several benefits regarding coal stability, economy and safety, several issues pertaining to logistics involved in coal supply chain are still unanswered which usually plays crucial role in organizational performance. Generally, extracted coal from mines is crushed to the desired size and stacked before loading over coal wagons. Daily, an average of 28,470 wagons coal is being transported by rail to meet the power demand. Improper coal loading over rail wagons comprises of under loading, over loading, uneven loading of coal, loading of coal/stone boulders and loading of slurry over wagon. The objective of this study is to find the bottlenecks in coal supply chain and how it impacts the power prices, safety, environment and to determine the perfect coal supply chain in the context of rail fed thermal power plants. This research employs a qualitative approach to gain in-depth insights. Data was collected through semi-structured interviews from 18 industry experts. NVivo software is used for analysis of the interview transcripts. The findings highlight various critical challenges associated with coal loading. Environmental degradation emerged as a prominent concern, encompassing air and water pollution. Several Logistical complexities were identified as significant factors influencing coal supply chain efficiency which directly influences the power prices. Ultimately, this study contributes to a deeper understanding of the coal supply chain and offers valuable insights for enhancing its efficiency and sustainability.*

Keywords*: Coal supply chain, loading irregularities, Under Loading, Over Loading, Uneven Loading, Loading of boulders over wagon*

Biological waste in South Africa, its management and related risk/policy implications.

Roman Tandlich*
Disaster Management and Ethics Research Group (DMERG), Rhodes University
**Corresponding Author: r.tandlich@ru.ac.za.*

ABSTRACT: *Biological waste is common and more important from the management point of view in the context of the recent COVDI19 pandemic. Plastics, everyday items and the need to see even inert object as potentially a source of the infectious disease and potentially death of human beings, as well as animals. The ISO standard 35001 defines biological risk and the differences between the Non-biological and biological risk. The case of inactivation and the probability of infectious disease transmission from plastic wastes, e.g. personal protective equipment will be presented Implications for the movement of the PPE throughout the world and potential risk to further infectious disease outbreaks, epidemics and pandemics will be discussed.*

Keywords*:*

Generalized Intuitionistic Trapezoidal Fuzzy Numbers in Transportation Problems: An Optimization Method

S. Jyothi, N. Ravi Shankar*
Dept. of Mathematics, GSS, GITAM (Deemed to be University), Visakhapatnam, India
**Corresponding Author: jsabbava@gitam.in*

ABSTRACT: *In this study, we propose an optimization method for transportation problems utilizing Generalized Intuitionistic Trapezoidal Fuzzy Numbers (GITFNs). This method effectively handles uncertainty and imprecision in transportation systems, enabling more realistic and reliable decision-making. A GITFN-based transportation model is developed, incorporating fuzzy costs, capacities, and demands. An optimization algorithm is designed to minimize transportation costs while satisfying supply and demand constraints. The method is applied to a numerical example, demonstrating its efficiency in solving complex transportation problems. The results show significant improvements in transportation effectiveness and cost reduction.*

Keywords*: Generalized Intuitionistic Trapezoidal Fuzzy Numbers, Transportation Problems, Optimization, Linear Programming, fuzzy ranking*

An Approach to Synergise the Management of Lean, Green Quality and Waste for Achieving ZED Emphasising SDG12

Raktim Dasgupta[1,*], Sadhan Kumar Ghosh[2], Arup Ranjan Mukhopadhyay[3]

[1]Jadavpur University, Department of Mechanical Engineering, Kolkata, India
[2]DG, SD&CE research centre, ISWMAW, Former, Jadavpur University, India
[3]ndian Statistical Institute, SQC&OR Division, Kolkata, India

**Corresponding Author: raktimdasgupta3@gmail.com*

ABSTRACT: *The advent of the Zero Defect and Zero Effect (ZED) concept has thrown a significant challenge in integrating quality management, lean philosophy, waste management, and green management within industrial operations. Achieving quality outcomes requires fulfilling both external and internal customer expectations through effective requirement analysis and meeting specific quality dimensions. At the same time, organizations must minimize resource usage—such as time, energy, manpower, and materials—while maintaining product quality. This is a core principle of lean management, which aims to improve margins and ensure organizational growth and survival. Simultaneously, environmental sustainability must be prioritized by minimizing air, water, and soil pollution, in line with green management principles. This study employs the Fuzzy Analytical Hierarchy Process (FAHP) to prioritize key parameters for assessing ZED performance across three industrial sectors in India. Additionally, it proposes practical methods for improving vital components using Six Sigma metrics to enhance operational excellence and sustainability. The novelty of this research lies in the integration of a ZED Maturity Model with the Business Excellence Model, along with the analysis of vital components through Six Sigma metrics to develop a comprehensive framework for improving operational performance and sustainability. This paper provides a theoretical framework and actionable strategies for researchers and practitioners to effectively integrate ZED principles, fostering sustainability and operational performance in manufacturing industries while supporting Sustainable Development Goal 12.*

Keywords*: ZED, SDG12, Resource Efficiency, Carbon Foot Print, Lean & Green Management*

Low Cost Housing Solutions

Mohammed Jalal, Mohammed Abdul Khaliq Marwan*, Farhan Quadri Bhati, Mohammed Amaan, Zaheer Khan

Lords Institute of Engineering and Technology

**Corresponding Author: akmarwan4299@gmail.com*

ABSTRACT: *The concept of low-cost housing solutions is essential in addressing the growing demand for affordable, sustainable housing, particularly in developing regions. With rapid urbanization and population growth, there's a need to create homes that are both economically feasible and environmentally conscious. Low-cost housing aims to optimize material usage, reduce construction costs, and improve living conditions for underprivileged communities while prioritizing eco-friendly practices and resource efficiency. This study will explore innovative methods for constructing low-cost housing using sustainable resources. Emphasis will be placed on utilizing renewable materials and techniques that minimize environmental impact. The methodology will incorporate materials that reduce dependency on expensive, high-carbon footprint resources while incorporating alternative construction technologies suited for cost-effective housing. A focus will be on maximizing structural strength, durability, and energy efficiency and develop a model that balances affordability with sustainability. The scope of this project extends beyond basic shelter provision and envisions creating durable, functional, and community-oriented spaces that align with environmental goals. Research findings and practical applications will provide a framework for low-cost, sustainable housing strategies that can be replicated across various regions. By focusing on resource efficiency and affordability, this project will contribute to the development of a sustainable, socially responsible approach to housing that can address the future needs of urban and rural communities worldwide.*

Keywords*:*

Collaborative Design with Circular Economy: Industry and Academia Partnerships in Designing for Sustainability

Deepali Gour*
School of Design, Avantika University, Ujjain (M.P.), India
**Corresponding Author: deepali.gour@avantika.edu.in*

ABSTRACT: *The research explores the role of collaborative design in embedding circular economy (CE) principles within design education, specifically through industry-academia partnerships. The circular economy framework, which emphasises minimising waste and maximising the lifecycle of materials, offers a promising alternative to the linear "take-make-dispose" model that has led to extensive environmental degradation. This paper follows an exploratory research approach to investigates how partnerships between academic institutions and industry practitioners can bridge the gap between theoretical understanding and practical applications of CE. Design for Sustainability (D4S) is integrated as a core component within academic curricula to foster the next generation of designers who are equipped to tackle sustainability challenges. The study examines current educational approaches in India, where institutions are beginning to incorporate CE into design courses, and presents examples of successful collaborations that produce real-world sustainability solutions. Findings underscore the importance of academia-industry synergy, where academia brings in research expertise and innovative methods, while industry provides practical exposure and resources. The paper proposes a structured framework for academia-industry partnerships in design education, aiming to catalyse systemic change towards sustainability by educating future designers. This research highlights the potential of such collaborations to promote a circular economy mindset, thus paving the way for sustainable practices across industries.*

Keywords*: Circular Economy (CE), Sustainable Design, Industry-Academia Partnerships, Design for Sustainability (D4S), Collaborative Design*

The Evolution of Green Retailing: A Systematic Literature Review

Pavan Sai Manikanta Puppala, V V Devi Prasad Kotni*
Department of Marketing, GITAM School of Business, Gandhi Institute of Technology and Management, Deemed to be University, Visakhapatnam, India
**Corresponding Author: devi_kvv@yahoo.c*

ABSTRACT: *Sustainability has received significant attention due to climate change evidence, United Nations sustainable development goals, pandemics, and the evolving behaviours of illennials. Green Retailing has become an essential aspect of sustainable business behaviour due to increasing consumer demand for ecologically responsible products and services. This systematic literature review (SLR) seeks to delineate the progression of green retailing by examining the advancement of fundamental concepts, techniques, and trends in the domain throughout recent years. The review consolidates insights from more than 60 peer-reviewed articles, reports, and case studies, offering a thorough examination of the theoretical underpinnings, operational methods, and obstacles encountered by merchants implementing green initiatives. The data utilised for this study were obtained by querying the Scopus database for the intersection of phrases pertaining to "green retail," "green retailing," "green shopping," or "green selling". The study addresses gaps in the current literature and suggests avenues for future research, highlighting the necessity for increased multidisciplinary methodologies and longitudinal empirical studies.*

Keywords*:*

Recent Efforts for Developing Strategic Planning in Egyptian Solid Waste Management for Egypt

F.I. Barakat[1], S.T. El-Sheltawy[1], Shereen Kamel Amin[2,*], A. Abdelghany [1]

[1]Chemical Engineering Department, Faculty of Engineering, Cairo University, Giza, Egypt.

[2]Chemical Engineering and Pilot Plant Department, Engineering and Renewable Energy Research Institute, National Research Centre (NRC), Affiliation ID: 60014618, Dokki, Giza, Egypt.

**Corresponding Author: sheren51078@yahoo.com*

ABSTRACT: *The main focused of this paper is to investigate the variability of the parameters involved in the estimation of the effect of legislations on the Egyptian Solid Waste Management ESWM as well as the contamination potential of Environmental Protection Organizations, authorities, and Agencies developed to apply and control all activities related to Solid Waste Management Systems. Egypt produces around 100 million tons of solid waste annually as reported by the National Solid Waste Management Programs NSWMP in 2023 with 85% collection rate at Urban areas and 35% at rural with a Municipal Solid Waste MSW generation rate between 0.6 and 0.8 kg/capita/day. The parameters considered to estimate the Egyptian Solid Waste Environmental problems and appropriate financial mechanisms were discussed in terms of their variation over time and their significance has been highlighted. The main recent environmental laws are: law 4/1994, law 9/2009, and law 202/2020, issued under the responsibility of the Ministry of Environmental Affairs. Implementation of some activities are supervised by two main Agencies: The Egyptian Environmental Affair Agency EEAA and Waste Management Regulatory Agency WMRA. Many other supplementary authorities are added to the environmental protection system to regulate industrial activities such as Industrial Development Authority and recently Financial Regulatory Authority have introduced scientific approach for Carbon Footprint CFP accreditation (2023) according to ISO 14067/2018. Many efforts have been conducted by experts during the last 10 years to develop a sustainable Solid Waste Management Strategy based on green concepts through shift of linear economy LE to Circular Economy CE, assessment and minimization of Carbon Footprint CFP and related Life Cycle Assessment LCA with final disposal facilities, either by Waste – to – Energy WTE alternatives or adding new sanitary landfills.*

Keywords*: Solid Waste Management; Carbon Footprint; Circular Economy; Landfill.*

Solid Waste Management Policy and Scenario of Implementation in Nepal

Dhana B. Tamang*, Kedar Rijal, Indira Parajuli
Central Department of Environmental Science, Tribhuvan University, Nepal
**Corresponding Author: dtamang0@gmail.com*

ABSTRACT: *Solid Waste Management (SWM) has been very challenging at present particularly in the large cities and burgeoning municipalities in Nepal. The reasons are numerous and to mention some are weak policies, inadequate institutional capacity, lack of resources, overlapping jurisdictions etc. The principles of SWM have been categorized based on the literatures review. The principles act as the basis of all the relevant policies. They can be listed as: i) Precautionary principle, ii) Integrated waste management, iii) Sustainability and circular economy, iv) Public, private, community and informal Sector partnership, v) Polluters pay principle, vi) Market based instruments and vii) Decentralized management, etc. The policies of some countries in the international arena both from the global north and south are reviewed. The USA has a well-defined and principle-based policy based on the Pollution Prevention Act with strong implementation arrangement like Environment Protection Agency (EPA). The European Union and Thailand has policies with measurable targets for their effective evaluation. There are numerous policies, laws and action plans related to SWM in Nepal. Nevertheless, while reviewing minutely, the policies do not encompass all the relevant principles and they are not based on evidence, and they lack practicability in implementation. Some policy gaps are identified in the course of this review. Similarly, policy implementation is also found to be very weak while analyzing their implementation status. So, Nepal needs to correct the policy gaps in one hand and improve implementation endeavors by managing resources, arranging efficient institutions and clarifying the roles and responsibilities of all the stakeholders.*

Keywords*: Solid Waste Management (SWM), SWM Principles and Policies, Municipal Solid Waste (MSW), Integrated Solid Waste Management (ISWM), Policy and Implementation Gaps*

Analysis of Critical Factors Contributing to Delays in Metro Rail Projects

Julian Patrick, Jayavelu*
Dr. M.G.R. Educational and Research Institute, Chennai, India
**Corresponding Author: julianpatric86@gmail.com*

ABSTRACT: *This paper examines the key reasons behind the frequent delays in metro rail projects, which often result in higher costs and inefficiencies. As urban areas expand, metro rail systems become vital for providing sustainable and reliable public transportation. However, these projects are quite complicated and often face delays due to a combination of technical, financial, legal, environmental, and management challenges. Each of these areas presents unique obstacles, such as design changes, funding acquisition, legal approvals, and stakeholder coordination, all of which contribute to extended project timelines and increased expenses. The study organizes these delay factors to better understand their impact on project performance, both individually and collectively. By analysing case studies and existing literature, it identifies common issues like land acquisition difficulties, funding delays, and stakeholder conflicts. These problems often accumulate over time, leading to even longer delays. The research emphasizes that without effective coordination; these challenges can quickly escalate, highlighting the need for a comprehensive approach that addresses the full spectrum of potential issues in metro rail projects. To address these delays, the paper proposes several practical strategies aimed at enhancing project management and minimizing risks. These strategies include utilizing advanced project management tools for improved oversight, streamlining the funding process to prevent interruptions, and effectively managing risks to identify potential issues early on. Actively engaging stakeholders is also essential for aligning interests and reducing conflicts. These recommendations are designed to assist industry professionals in better planning and managing metro rail projects, ensuring they remain on schedule. By providing a structured framework, this paper serves as a valuable resource for managing delays in large infrastructure projects, helping cities create more efficient and reliable transportation systems as they continue to grow.*

Keywords*: Construction, Metrorail transport, Time overrun, Critical factors.*

Adaptive Reuse Approach: Recycling For Interior Design Furniture and Accessories

Mary Ann Venturina Bulanadi*

College of Fine Arts & Design, Research Center for Culture, Arts and Humanities University of Santo Tomas, Philippines

**Corresponding Author: mvbulanadi@ust.edu.ph*

ABSTRACT: *The paper explores the potential of sustainable art and design through repurposing old interior design pieces (furniture and accessories), whose destiny seems to be traditionally towards waste disposal. For example, an intricately carved narra door can be repurposed as part of a headboard or a wall piece. It intricately intertwines conceptualism, sustainability, and historical conservation. The research aims to present how the physical (tangible) aspects can be restored and its stories (intangible) highlighted, providing an opportunity for the pieces to be relevant within a contemporary narrative and within the context of their new environments or their new place of installation. As such, this will also advocate the engagement of waste management, of creativity, and most especially of art and design. This research presents an approach that lends the concept of adaptive reuse into tangible pieces rather than spaces by breathing new life and opportunity into discarded interior design pieces (furniture and accessories), thereby fostering environmental and cultural conservation. By preserving key elements of the original items, then modifying it with a newly-developed purpose and design, the research then positively connects two seemingly opposite handling of materials--waste management on the one hand, and creative expression on the other. This approach promotes responsible resource utilization, supports local conservation efforts, and encourages designers to engage in sustainable waste management practices. In the process, the practice of recycling and repurposing positions adaptive reuse as a critical strategy for sustainable design as rendered into tangible heritage pieces.*

Keywords*:*

Case study on value engineering in construction and Advanced construction techniques

Jacob Selvaraj S*, Depaa RA B, A. Hemamalinie
Dr. M.G.R. Educational and Research Institute, Chennai, India
**Corresponding Author: sjacob77@gmail.com*

ABSTRACT: *In order to balance variables such as money, time, efficiency and quality, current construction methods require a significant amount of work. The construction sector, when compared to the other industries, seemed to be the hardest to work with. It has been shown that certain contemporary methods may be readily adapted to the project in order to achieve a balance between the variables listed above. The purpose of this study is to determine if Value Engineering (VE) is a useful technique for improving the overall quality of construction. The aim is to provide high-quality services at a reasonable cost. the significance of the worth Applied engineering is a technique that is used to analyse the functionality of products, services, and access the best possible quality performance is needed of the good and service user at the lowest possible overall cost without any limitations. Intensive, multidisciplinary problem-solving activity is taking place. In particular, it is concerned with increasing the value of tasks that are necessary to accomplish the objective (or goals) of any product, process, service, or organisation. When we were working on this project, we spoke about the idea of value. Value Engineering may play a critical part in ensuring that programmes remain within budget or even save money when it comes to cost savings. A highly innovative and successful method, value engineering, must be recognised and understood at all levels of project management, and it must be embraced across the globe.*

Keywords*: Value Engineering, Cost effective in projects*

Analysis of Critical Factors Contributing to Delays in Metro Rail Projects

Julian Patrick, Jayavelu*
Dr. M.G.R. Educational and Research Institute, India
**Corresponding Author: joselivi1996@gmail.com*

ABSTRACT: *This paper examines the key reasons behind the frequent delays in metro rail projects, which often result in higher costs and inefficiencies. As urban areas expand, metro rail systems become vital for providing sustainable and reliable public transportation. However, these projects are quite complicated and often face delays due to a combination of technical, financial, legal, environmental, and management challenges. Each of these areas presents unique obstacles, such as design changes, funding acquisition, legal approvals, and stakeholder coordination, all of which contribute to extended project timelines and increased expenses. The study organizes these delay factors to better understand their impact on project performance, both individually and collectively. By analysing case studies and existing literature, it identifies common issues like land acquisition difficulties, funding delays, and stakeholder conflicts. These problems often accumulate over time, leading to even longer delays. The research emphasizes that without effective coordination, these challenges can quickly escalate, highlighting the need for a comprehensive approach that addresses the full spectrum of potential issues in metro rail projects. To address these delays, the paper proposes several practical strategies aimed at enhancing project management and minimizing risks. These strategies include utilizing advanced project management tools for improved oversight, streamlining the funding process to prevent interruptions, and effectively managing risks to identify potential issues early on. Actively engaging stakeholders is also essential for aligning interests and reducing conflicts. These recommendations are designed to assist industry professionals in better planning and managing metro rail projects, ensuring they remain on schedule. By providing a structured framework, this paper serves as a valuable resource for managing delays in large infrastructure projects, helping cities create more efficient and reliable transportation systems as they continue to grow.*

Keywords*:*

The Electric Vehicle Market in India: A Pathway to Sustainable Growth

Shivabeerappa M[1], Divya L[2]

[1]MMK & SDM Mahila Mahavidyalaya, Mysore, Karnataka, India
[2]JSS College of Arts, Science and Commerce, Ooty Road, Mysore, Karnataka, India
**Corresponding Author: shivabeerappa@sdmmmkmysore*

ABSTRACT: *This study examines the factors influencing sustainable development in India's electric vehicle (EV) manufacturing sector. It aims to assess the roles of key stakeholders, including manufacturers, distributors, and consumers, in promoting EV adoption, and evaluates the effectiveness of government policies, incentives, and regulations in overcoming barriers to market growth. Using a mixed-method approach, this research collected data through surveys from 110 consumers and 30 manufacturers and distributors in the EV sector. Factor analysis and reliability tests were employed to identify and evaluate the primary factors contributing to or hindering sustainable development in EV manufacturing. The study identified five critical factors: technological advancements, infrastructure challenges, supply chain sustainability, policy support, and workforce development. Results show that while government incentives and advancements in battery technology positively impact EV adoption, barriers like limited charging infrastructure, high costs, and lack of consumer awareness significantly hinder progress. Insights from this study provide a basis for policy recommendations and strategic actions. Enhancing infrastructure, increasing incentives, and fostering technological innovation are essential for promoting EV adoption. Additionally, targeted awareness campaigns can improve consumer perceptions and increase demand for EVs in India. This paper contributes to the limited body of research on sustainable EV manufacturing in India, offering a comprehensive view of the industry's current state and future potential. It provides actionable insights for policymakers, industry stakeholders, and researchers seeking to support sustainable growth in the EV market.*

Keywords*:*

XVII. Remediation

Modelling a New Information System for Phytoremediation Data [PRIS]

Ponni Ganesan[1,*], A B Sagar[2], P V Rekha Devi

[1]Maris Stella College, Vijayawada, A.P, India
[2]National Informatics Center, APSC, India

**Corresponding Author: dr.ponni.g@gmail.com*

ABSTRACT: *Phytoremediation uses plants to remove pollutants from the environment. Using green plants for remediation of pollution is an attractive way of sustainable development. Phytoremediation uses a large number of plants and pollutants. The plant database has nearly 47,520 plants and the pollutants database has more than a thousand pollutants. Thus a need is felt for the development of an information system to manage phytoremediation information, view phytoremediators' treatment efficiencies, effectively compare various phytoremediators for their performances to find out potential phytoremediators for treating specific pollutants. The authors not only detailed the design and modelling of the information system, but also implemented the system and found it working as per the proposed design specification. The present paper discusses the modelling of the information system for managing phytoremediation information. The proposed information system is called Phytoremediation Information System (PRIS). PRIS is designed to be an adaptive, open, socio-technical system with properties of self-organisation, scalability and sustainability.*

Keywords*:*

Ecological Restoration through Advanced Bioremediation: Harnessing Marine Fungi for Oil Spill Cleanup at Visakhapatnam Port

Chandana Chintu*, Kiranmayi Patnala

Biotechnology Division, Department of Life Sciences, School of Science, GITAM (Deemed to be University), Visakhapatnam, India

**Corresponding Author: cchintu@gitam.in*

ABSTRACT: *Crude oil spillages in the oceans pose significant risks to marine ecosystems, adversely affecting marine life and human health. The toxic components of crude oil, such as polycyclic aromatic hydrocarbons (PAHs), disrupt aquatic habitats, leading to bioaccumulation in marine organisms, and ultimately entering the human food chain, causing long-term health hazards. Bioremediation, an eco-friendly method leveraging microbial metabolism to degrade pollutants, offers a sustainable solution to this pressing issue. The unique abilities of fungi to sustain and thrive in saline environments fluctuating temperatures and low nutrient availability make them better bio-degraders.*

The current study focuses on exploring the efficacy of indigenous fungi present in the Visakhapatnam port to utilize crude oil as the sole carbon source and breakdown the petroleum hydrocarbons without interrupting the marine ecosystem. We have isolated and cultivated native fungal species possessing the ability to survive in oil contaminated sites. The ability of the isolated fungi to metabolize crude oil is assessed employing three main methods like DCPIP (2,6 dichlorophenol-indophenol) dye method, fungal dry weight measurement and gravimetric method. The results demonstrated that certain fungal strains belonging to Aspergillus and Penicillium species have exhibited significant bioremediation capabilities, with marked reductions in crude oil concentrations across all methods. The findings underscore the potential of native fungi as effective agents for bioremediation in marine environments contaminated by crude oil, providing a sustainable alternative to conventional methods.

Keywords*: Marine fungi, bioremediation, Visakhapatnam port, DCPIP method, gravimetric method.*

Eco-Friendly Conversion of Water Hyacinth (Eichhornia Crassipes) into Vermicompost for enhanced Plant Growth

Princy Sudhakar*, G. Chitra
Nirmala College for Women (Autonomous), Coimbatore, Tamilnadu, India
**Corresponding Author: princysudhakar0611@gmail.com*

ABSTRACT: *Water hyacinth (Eichhornia crassipes), one of the world's most invasive aquatic plants, poses a significant environmental threat due to its rapid growth, clogging of water bodies, and disruption of local ecosystems. Traditional methods to control this weed have proven inefficient, and the challenge of its disposal remains unresolved. This study explores an eco-friendly approach to manage water hyacinth by converting it into nutrient-rich vermicompost using the indigenous earthworm species Eudrilus eugeniae. Water hyacinth collected from Sulur Lake in Coimbatore was combined with cow dung and subjected to a 75-day vermicomposting process. The vermicompost produced was analyzed for its physicochemical properties and nutrient content. Results indicate that vermicomposting water hyacinth significantly increases the levels of essential macro and micronutrients such as calcium, magnesium, phosphorus, sodium, and potassium compared to traditional composting methods. The study also evaluated the effectiveness of the water hyacinth-based vermicompost on the growth of fenugreek (Trigonella foenum) and horse gram (Macrotyloma uniflorum). Plants grown in the water hyacinth vermicompost demonstrated enhanced root and shoot length, as well as improved leaf breadth, suggesting that this compost can be a potent organic fertilizer. This approach not only provides a sustainable method for managing water hyacinth but also offers a low-cost solution for enhancing soil fertility and supporting agricultural productivity. The findings contribute to ongoing efforts to find sustainable uses for invasive plant species and promote environmentally friendly agricultural practices.*

Keywords*: Water hyacinth, Vermicomposting, Eudrilus eugeniae, Nutrient-rich compost, Sustainable*

Evaluating the efficacy of Alum and Spirulina for Wastewater Remediation: A Comparative Analysis

B. Thirumalaiyammal*, P.F. Steffi
Department of Microbiology, Cauvery College for Women, (Autonomous), (Affiliated to Bharathidasan University), Annamalai Nagar, Tiruchirappalli, Tamil Nadu, India
**Corresponding Author: puvi.divs@gmail.com*

ABSTRACT: *The unregulated release of wastewater laden with suspended solids poses a grave threat to natural water ecosystems, escalating pollution levels and imperilling aquatic life. Turbidity, crucial in water treatment, especially for potable water, emerges as a significant concern. While chemical treatments effectively reduce turbidity, their by-products contribute to environmental pollution and ecosystem degradation. This study compares Spirulina and alum in wastewater treatment, focusing on their impact on chemical parameters and water quality. Spirulina's nutrient absorption abilities and alum's conventional coagulation were evaluated for their potential in wastewater remediation. Spirulina notably reduced nitrate levels to 4.6 mg/L, surpassing untreated wastewater and tap water, showcasing its prowess in nitrogen removal. Additionally, it effectively decreased chloride to 0.059556 mg/L and significantly raised dissolved oxygen to 246.30 mg/L, crucial for aquatic life support. Alum treatment, while less pronounced, showed commendable reductions in nitrate and chloride and improved dissolved oxygen (8.92 mg/L, 0.4565 mg/L, and 94.58 mg/L, respectively). Both treatments mitigated phosphate, with Spirulina achieving a lower concentration (539,215.68 mg/L) than alum (8,400 mg/L). Overall, Spirulina exhibited slightly superior efficacy in reducing nitrate and chloride and significantly enhancing dissolved oxygen, while alum excelled in phosphate removal. Choosing between them should consider specific pollutant removal goals and operational factors, with Spirulina favored for overall pollutant reduction and enhanced oxygenation, and alum for efficient phosphate removal.*

Keywords*: Wastewater treatment, Spirulina platensis, alum, chemical parameters, water quality enhancement, sustainable water management.*

Utilizing Sewage Sludge Biochar as an Effective Method for Remediating Hexavalent Chromium (Cr(VI)) in Contaminated AQUEOUS Solution

Akash M Raj*, Prathima B, Sainath K
B.M.S College of Engineering, Bengaluru, India
**Corresponding Author: akash.cee22@bmsce.ac.in*

ABSTRACT: *Water pollution caused by urban and industrial activities has emerged as a significant issue over the past decade. The dwindling natural water bodies and aquifers can be addressed by reusing treated effluents. The Heavy metals such as Chromium, Cadmium, Zinc, Nickel and Copper released from the industries, undergo bio-concentration, proving toxic even in minimal quantities. While chromium is essential for carbohydrate metabolism, it becomes detrimental at elevated concentrations. Hexavalent chromium, Cr(VI), is particularly common, and its toxicity raises significant environmental and public health issues. Several remediation techniques are available for reclaiming effluent contaminated with Hexavalent Chromium after treatment. This paper seeks to compile concise information on the removal of hexavalent chromium through laboratory studies, aiming to facilitate wastewater treatments. In this research, sewage sludge biochar was synthesized to treat wastewater containing Cr(VI) by utilizing municipal sludge as the precursor material, followed by modification with hydrogen peroxide. The biochar was generated from sewage sludge via a pyrolysis process conducted for 2 hours at 550°C in a muffle furnace under a nitrogen atmosphere and was subsequently treated with hydrogen peroxide. The biochar was characterized using BET and FTIR analyses to evaluate the surface area and the presence of functional groups in the synthesized material. Laboratory-scale experiments were performed on aqueous solutions spiked with Cr(VI). Batch experiments with Cr(VI)- contaminated water samples revealed that different chemical and environmental factors, such as initial concentration, dosages, contact time, and pH, influenced the removal efficiency. The findings indicated that hydrogen peroxide modified biochar achieved a 40% removal rate of Cr(VI) under acidic conditions. The Cr(VI) removal process fitted well for non-linear Langmuir isotherm and pseudo-First-order kinetic model. This study demonstrates the potential of hydrogen peroxide-modified biochar derived from sewage sludge as an effective material in mitigation of Cr(VI) contamination in water.*

Keywords*: Adsorption; Hydrogen Peroxide; Heavy Metal; Sewage Sludge; Biochar.*

Phytoremediation – A Sustainable Method for Heavy Metal Removal

Sankari. M*, M. Reshma Anjum, Narasimha Golla*
Sri Padmavati Mahila Visvavidyalayam, Tirupati, India
**Corresponding Author: sankarijanaki@gmail.com*

ABSTRACT: *The rapid growth of industries has recently heightened the heavy metal pollution problem, as the demand for numerous metals is expanding for production needs. Although numerous metals are naturally occurring and exist in soil, pollution occurs when anthropogenic activities cause the levels of these metals increase. However, a variety of methods are being employed to clean up contaminated regions. A promising technique among them is phytoremediation, which uses hyper-accumulator plant species that can withstand high concentrations of hazardous heavy metals (HMs) in the soil or environment. Such a strategy uses green plants to remove, degrade, or detoxify toxic metals. Five types of phytoremediation technologies have often been employed for soil decontamination: phytostabilization, phytodegradation, rhizofiltration, phytoextraction and phytovolatilization. The benefits of phytoremediation as an eco-friendly, economical, and effective remediation technique are drawing interest from a variety of researchers. In order to improve the effectiveness of plants as candidates for HMs decontamination, genetic engineering techniques like transgenic transformation, phytoremediation assisted with phytohormones, plant growth-promoting bacteria have been used. The source of heavy metals and the mechanisms and methods of phytoremediation during heavy metal removal will be focussed.*

Keywords*: Phytoremediation, heavy metals, Hyper-accumulator plant, Phytohormones.*

Biochar for waste management and environmental remediation: a green and sustainable technology?

Santanu Mukherjee*
School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Solan, India
**Corresponding Author: santanu_mukherjee86@yahoo.co.in; santanu@shooliniuniversity.com*

ABSTRACT: *Biochar is typically defined as a carbonaceous, stable, and recalcitrant product obtained on the thermal treatment of carbon-containing biomass in a limited supply of oxygen. The composition and properties of biochar are mainly dependent on the thermal treatment technique, the treatment temperature, and the feedstock type. Different techniques have been utilized for biochar production such as torrefaction, carbonization, combustion, gasification, and pyrolysis, with pyrolysis being most commonly used due to its simplicity and high yield of production. A wide range of feedstocks has been used previously including kitchen waste, agricultural wastes, leaf litter, wood biomass, rubber tyres, poultry litter, animal litter, sewage sludge, and algae. Biochar application could also help in climate-smart agriculture, waste management, clean energy production, contaminant removal, and climate change mitigation. Biochar amendments have been proposed to ameliorate the adverse effects of temperature rise on soils and plants. The application of biochar improves the thermal properties of soils. Reflectance reduced in the infrared wavelength range and increased in blue-light and near-ultraviolet range. Amendment of soil with biochar reduces the bulk density and thermal diffusivity of soil and improves its moisture content. These changes affect the thermal conductivity and reflectance of soil which ultimately moderates the soil temperatures. These changes could also influence plant growth and biochemical processes in soil. Further, soil depth, soil moisture content, and biochar application rates affect soil temperature and volumetric heat capacity. The reduction in organic matter and clay fraction with a rise in soil temperature decreases the cation exchange capacity of the soil. Biochar has a high surface area, which coupled with an abundance of carboxyl and hydroxyl groups, helps in improving its cation exchange capacity. Consequently, the addition of biochar to soils helps in enhancing its cation exchange capacity. With regards to microbial activity, an increase in soil temperature affects the soil microbes. However, the addition of biochar to soil supports microbial proliferation and the community structure. The high surface area, enhanced porosity, escalated pH, increased electrical conductivity, surplus moisture retention, and abundant organic matter support the microbial activity in the soil. The present invited talk will focus on how biochar is becoming popular in environmental remediation and playing an important role in the sustainable decontamination of toxicants.*

Keywords*:*

Exploitation of Silver Nanoparticles in Bioremediation

M. Reshma Anjum[1], T. Lahari[1], M. Sankari[2], Narasimha Golla[2,*]
[1]Dept. of Biotechnology, Sri Padmavati Mahila Visvavidyalayam (Women's University) Tirupati, India
[2]Dept. of Virology, Sri Venkateswara University, Tirupati, India
**Corresponding Author: dr.g.narasimha@gmail.com*

ABSTRACT: *Bioremediation involves living organisms and substances. To treat or detoxify toxic wastes /pollutants in an environmentally friendly way. This includes plants, microorganisms, fungi, and various physical and chemical substances. It can detoxify many types of organic and inorganic pollutants such as heavy metals, various types of pesticides and herbicides. The use of microorganisms for this purpose is the most common because they can be used anywhere, both indoors and outdoors. Bioremediation is a sustainable technique for removing pollutants from contaminated areas while leaving non-toxic products on the site. Silver nanoparticles in combination with plants and microorganisms have been found to Improve the remediation of environmental pollution that consist of large tracts of polluted sites plagued with the waste materials. Hence nanotechnologies have the ability to minimize pollution by improving the microbial activity in specific wastes and could potentially catalyse the degradation of most of the environmental contaminants and this helps in reducing the overall cost. Microbes can be widely applied for nanoparticles production due to easy handling and Methoding requirement of low-cost medium such as agro-wastes simple scaling up economic viability with the ability of adsorbing and reducing metal ions into nanoparticles through metabolic methods. In this we discuss the use of silver nanoparticles along with microbial enzymes for bioremediation for detoxification of organic or inorganic pollutants for clean up the environment.*

Keywords*: Silver nanoparticle, agro-waste, sustainable, Microorganism, Metabolism.*

Assessment of Phyto-Electrokinetic Remediation of Heavy Metals from Sewage Sludge by using Brassica Junce

Tamanna Parida, Namuduri Srinivas*

GITAM School of Science, GITAM (deemed to be University), Vishakhapatnam, Andhra Pradesh, India

**Corresponding Author: snamudur@gitam.edu*

ABSTRACT: *Sewage sludge (SS) is a byproduct of wastewater treatment processes. While it's a valuable resource rich in organic matter, nutrients, and micronutrients, it can also pose significant environmental risks due to its potential contamination with heavy metals (HMs). The presence of HMs in SS can hinder its beneficial use in agriculture and impact human health. When applied to fields, plants can absorb these metals and enter the food chain, potentially causing serious health problems. Traditional methods for removing HMs from SS, such as chemical treatments, are often expensive and environmentally unfriendly. To address this issue, many techniques have been explored, and out of that, the hybrid method of phyto-electrokinetic treatment (EKT) came up as a sustainable remediation process. EK is a technology that uses electrical currents to mobilize pollutants, including HMs, from contaminated soil or sludge. Phytoremediation is a green technology that utilizes plants to remove pollutants from the environment. Hyperaccumulator plants, such as Indian mustard (Brassica juncea), can absorb and accumulate high concentrations of HMs from the soil. In the study you mentioned, researchers applied the hybrid EK-phytoremediation approach to treat HM-contaminated SS.The study found that EK treatment effectively mobilized HMs from the SS, making them more bioavailable for plant uptake. Brassica successfully absorbed and accumulated HMs, particularly non-essential elements like lead, from the treated SS. The plants showed tolerance to the metal stress, demonstrating the potential for using phytoremediation to clean up contaminated sites. The successful application of this hybrid approach offers an advanced solution for the sustainable management of SS. By combining the power of technology and nature, we can mitigate the environmental risks associated with HM contamination and promote the beneficial use of this valuable resource.*

Keywords*: Hyper accumulator; Electro-kinetic remediation; Tolerance index; Heavy metals; Sludge.*

Nanobioremediation: Harnessing Nanotechnology for Enhanced Environmental Cleanup

Bojjala Sravya[1,*], Sagi Sowmika[1], M.M. Kesavulu[1], Narasimha Golla[2]

[1]Department of Biotechnology, Mohan Babu University, Tirupati, India
[2] Department of Virology, Sri Venkateswara University, Tirupati, India

**Corresponding Author: sravssravya333@gmail.com*

ABSTRACT: *Nanobioremediation, a novel interdisciplinary approach, combines the principles of nanotechnology and bioremediation to advance the remediation of environmental pollutants. This paper explores the development and application of various nanoparticles such as metal oxides, carbon-based nanomaterials, and zero-valent iron nanoparticles. These are particularly effective in addressing complex contamination issues due to their high surface area, reactivity, and versatility. The nanoparticles enhance contaminant breakdown and stabilization through adsorption, catalytic degradation, and redox reactions, often in collaboration with microbial agents. The synergy between nanoparticles and microbes creates a powerful, accelerated remediation system capable of handling diverse pollutants, from heavy metals (cadmium, lead) to organic contaminants like hydrocarbons and pharmaceuticals. Nanobioremediation shows great promise in the treatment of contaminated soils and water, offering improved efficiency and adaptability in both in-situ and ex-situ applications and also offers numerous advantages, including faster degradation rates and reduced ecological footprint compared to conventional methods, several challenges remain. Potential nanoparticle toxicity, environmental persistence, and recovery complexities raise concerns that require careful management and further study. This review discusses these limitations and highlights emerging strategies for overcoming them, such as developing eco-friendly, biodegradable nanomaterials and genetically engineering microbes to enhance nanoparticle compatibility. Future research directions emphasize large-scale field trials and establishing regulatory frameworks to support safe and effective nano bioremediation practices.*

Keywords*: Nanobioremediation, nanoparticles, degradation, stabilization, toxic substances*

Assessing the Phytoremediation Potential of Ornamental Plants in Heavy Metal-Contaminated Soils

Eswara Reddy Orekanti[1,2], Pushpanjali M.[1], Hari Prasad M.[1], Sowmika Sagi* [1], Sravya Bojjala[1], Kesavulu Muppuru Muni[1]

[1]Mohan Babu University, Tirupati, Andhra Pradesh,India
[2]Sri Venkateswara College of Engineering (Autonomous), Tirupati, Andhra Pradesh,India
**Corresponding Author: sagisowmika117@gmail.com*

ABSTRACT: *The increasing industrialization and technological advancements have led to significant environmental degradation, notably soil and water contamination. Heavy metals and metalloids released from various anthropogenic sources pose serious threats to ecosystems and human health. Phytoremediation, a green technology, utilizes plants to clean up contaminated sites by absorbing, degrading, or immobilizing pollutants. Phytoremediation is the use of vegetation for in situ treatment of contaminated soils, sediments, and water. It is applicable at sites containing organic, nutrient, or metal pollutants that can be accessed by the roots of plants and sequestered, degraded, immobilized, or metabolized in place. For heavy metal-contaminated soil, four processes of phytoremediation are recognized; they are phytoextraction, phytostabilization, phytovolatilization, and rhizofiltration. It has been reported that for phytoremediation, grasses are the most commonly evaluated plants. This technology can provide a low-cost solution to remediate contaminated areas, especially abandoned industrial sites. In recent years, major scientific progress has been made in understanding the mechanisms of soil heavy metal bioavailability and heavy metal uptake and transport by hyperaccumulators. For better outcomes of the results through the process of phytoremediation, it requires technology-based research work in order to monitor the metallic concentration and its accumulation in different soils. The present study investigates the potential of three ornamental plant species (Tagetes, Candytuft, and Crossandra) to remediate heavy metal (Cr, Cd, and Pb) contaminated soil. Results indicate that Tagetes and Candytuft exhibit significant lead remediation capabilities, reducing lead levels by up to 60%. Further research is necessary to optimize phytoremediation techniques, including the identification and engineering of hyperaccumulator plants and the development of advanced monitoring technologies. By harnessing the power of nature, phytoremediation offers a sustainable and cost-effective solution to address environmental pollution.*

Keywords*: Heavy Metals, Accumulation, Phytoremediation, Hyper Accumulators, Phytoextraction*

Experimental investigations on leaf biomass hydrochar for remediation of hexavalent chromium from aqueous solution

Sagani Sai Gayathri[1,*], Krishnamurthy Sainath[2], Prathima B[3]

[1]Environmental Engineering, B.M.S College of Engineering, Bengaluru, India
[2]Department of Chemical Engineering, B.M.S College of Engineering, Bengaluru, India
[3]Department of Civil Engineering, B.M.S College of Engineering, Bengaluru, India

**Corresponding Author: sagani.cee22@bmsce.ac.in*

ABSTRACT: *Heavy metal contamination in water bodies is a critical environmental concern due to its toxic effects on ecosystems and human health. Among these metals, hexavalent chromium (Cr(VI)) poses significant threats due to its high toxicity, carcinogenicity, and mobility in water. The prevalence of chromium in industrial effluents from processes such as electroplating, leather tanning, and mining has led to its accumulation in aquatic environments, necessitating effective remediation strategies. This study investigates the efficacy of leaf biomass hydrochar in removing hexavalent chromium (Cr(VI)) from spiked water. In this project, hydrochar was produced from leaf biomass of Pongamia pinnata or Indian beech tree through hydrothermal carbonization (HTC) and characterized for its physicochemical properties. The pristine hydrochar was modified using 10% H2O2 solution in order to increase adsorption capacity & hence, removal efficiency of hexavalent chromium from aqueous solution. The hydrochar was characterized using techniques such as BET surface area analysis and scanning electron microscopy (SEM) to understand its structural properties. Batch experiments were conducted to assess the chromium removal capacity of modified Hydrochar with varying hydrochar dosages, pH, initial concentration and contact time were conducted on Cr(VI) in water. The porous structure of the modified hydrochar was confirmed through SEM analysis and the surface area was found to be 5.1821 m^2/g. From the batch experiments, it was found that a maximum removal efficiency of 75% was achieved at pH 2 and a hydrochar dosage of 3 g/L of modified Hydrochar. Cr(VI) removal process followed pseudo-second order kinetics. This study demonstrates the potential of Pongamia pinnata leaf biomass hydrochar as an effective adsorbent for mitigating chromium contamination in water.*

Keywords*: Adsorption; Hydrogen peroxide; Hexavalent chromium; Leaf biomass hydrochar.*

XVIII.
Solid Waste Management
– Municipal Waste, Construction & Development Waste, Composting and Landfill

Infection Prevalence in Ragpickers – A Meta-Analysis Study

Payala Vijayalakshmi*
Department of Microbiology, GITAM Institute of Medical Sciences and Research, GITAM Deemed to be University, Visakhapatnam, India
**Corresponding Author: vpayala@gitam.edu*

ABSTRACT: *Rag pickers play a crucial role in waste management in many developing countries by collecting, sorting, and recycling waste materials. Ragpickers are skilled at identifying valuable recyclable materials and segregate the waste more effectively, ensuring that recyclable and non-hazardous materials are recovered safely. They often lack personal protective equipment (PPE) and are at high risk of exposure to infectious agents, sharp objects, and hazardous chemicals specifically in segregating the biomedical waste. Ragpickers are at significant risk of infections due to their exposure to various types of waste, including biomedical waste. This exposure can lead to various health issues, ranging from minor infections to severe diseases. They may have the chances of getting the infections like Tetanus, which enter through cuts or puncture wounds, Tuberculosis, Hepatitsis B or C or HIV with infected blood or body fluids or any fungal infections etc. Working in unsanitary environments with inadequate access to clean water and hygiene facilities heightens the risk of infections. Ragpickers often lack access to regular medical check-ups, vaccinations, and prompt treatment for injuries and infections. The present study is a meta-analysis study utilizing a statistical tool for the results of multiple studies involving infection prevalence in rag pickers. The study will helpful for improving the health policies, regular medical check-ups, vaccination in rag pickers, implementation of more training programmes on segregation of waste specifically biomedical waste in health care facilities, training programme on hand hygiene etc.*

Keywords*: Waste management, Rag Pickers, Infection, Hand hygiene, Segregation.*

Assessing the Efficiency of a Sewage Treatment Plant in Removing Physicochemical and Microbial Contaminants in Treated Reuse Water

Asha Elizabeth V.S., Anand Madhavan*
School of Environmental Studies, Cochin University of Science and Technology, Kerala, India
**Corresponding Author: anandm@cusat.ac.in*

ABSTRACT: *Sewage treatment plants (STP) are made mandatory for all large buildings including commercial buildings, government and private structures where the built up area is more than 2000 sq.m. The STP aims to deliver treated reuse water, which are used for non-potable functions like flushing toilets, gardening, cleaning etc. The study evaluates the efficiency of five sewage treatment plants in Kochi, to remove contaminants to meet the standards for physical-chemical-microbial parameters ensured by the central pollution control board, in reusing water. Two set of samples were collected from different treatment stages of the plants in a year and is analysed using APHA method. The results show the satisfactory performance of the STP with 99% removal of physicochemical parameters. However disinfection process seems to be ineffective in terms of microbial removal, presence of coliforms were found at two sites. The MBBR based treatment plants with ultrafiltration system ensures efficient removal of contaminants but the disinfection process needs to be thoroughly checked before being reused. An additional disinfection process or increase in the concentration dosage of sodium hypochlorite shall be entrusted before being discharged to reuse. Reused water needs to be monitoring regularly to avoid any potential health risk.*

Keywords*: STP, Total coliform, wastewater, treated water, health risk. BOD, COD.*

Assessing the Nutraceutical Potential of Fruit-Waste Enriched Antidiabetic Snack Bar: Treating Disease through a Sustainable Spectrum

Soumya Singh*, Komal Chauhan
NIFTEM, Kundli, Sonepat, Haryana, India
**Corresponding Author: soumyas685@gmail.com*

ABSTRACT: *As the plethora of diseases is increasing, so is the usage of functional foods (Birch et al. (2019)). Amongst all the varieties of functional foods available in the market, snack bars have attracted the primary attention since the research suggests that bakery goods have the strongest potential to act as "vehicles" for functional food development (Gill et al. (2017)). With this as the central theme of the study (Sun-Waterhouse et al. (2010)), the present study aims at developing snack bar which cannot only treat disease but also achieve the concept of "circular bioeconomy" by using fruit waste (Henson et al. (2008)) as one of its key ingredients for disease treatment. DPPH, amino acid profiling, glycemic load, DSC and FTIR was conducted of the major ingredients and the bar mix. DPPH result confirmed unbaked (unpasteurized) bar variant as the best. Amino acid profiling results suggested that leucine is high in all the major ingredients and the bar mix, which can be attributed to be the major reason for antidiabetic potential of the product (Yang et al. (2010)). Unbaked (unpasteurized) bar has the least glycemic load. Substantial DSC results were observed in case of APP, which gave insight into the amount of energy consumed in processing of solid pomace into dry powder due to starch gelatinization. FTIR analysis of apple pomace powder discusses how each of its functional groups have immense scope in the modern drug delivery system. In-vitro and ex-vivo studies proved that unbaked (unpasteurized) bar showed the maximum antidiabetic potential.*

Keywords*: Functional foods, snack bar, circular bioeconomy, fruit waste, antidiabetic.*

Enhancing Coir Pith for Agriculture: UV Radiation's Impact on Electrical Conductivity and Chemical Properties

Umalakshmi K S[1], Abesh Reghuvaran[2,*]
[1]School of Environmental Studies, Cochin University of Science and Technology, Cochin, India
[2]Centre for Science in Society, Cochin University of Science and Technology, Cochin, India
**Corresponding Author: abesh199@cusat.ac.in*

ABSTRACT: *Coir pith, a byproduct of the coir industry, which is widely used as a growing medium in Agriculture and horticulture. Elevated electrical conductivity (EC) levels in coir pith, primarily due to soluble salts, can adversely affect plant growth. This research aims to evaluate various pretreatment techniques to reduce EC, thereby enhancing coir pith which is suitable for agricultural applications. In this study, coir pith samples underwent controlled UV radiation exposure. The electrical conductivity of both treated and untreated samples was measured using conductivity meter. The results demonstrated a significant reduction in electrical conductivity in the UV-treated coir pith compared to the untreated samples. This decrease can be attributed to the photodegradation of conductive compounds within the coir pith. UV radiation breaks down complex organic molecules, thereby reducing their ability to conduct electricity. To further understand the chemical changes, the coir pith's characteristics were analysed using Scanning Electron Microscopy coupled with Energy Dispersive X-ray Analysis (SEM-EDAX). This analysis provided a detailed estimation of the elemental composition of the raw and treated coir pith samples. The findings highlight the efficacy of UV radiation in modifying the chemical properties of coir pith, resulting in reduced EC. This treatment method holds significant implications for enhancing the utility of coir pith in various agricultural and environmental applications, thereby increasing its value and sustainability.*

Keywords*: Coir pith, Electrical conductivity, UV radiation, agriculture, sustainability.*

A Study on Biosorbents for the Removal of Chloride ion from Water

Subhashish Dey*, G.T.N. Veerendra

Department of Civil Engineering, Seshadri Rao Gudlavalleru Engineering College, Andhra Pradesh, India

**Corresponding Author: subhasdey633@gmail.com*

ABSTRACT: *The presence of pollutants in aqueous solution particularly from hazardous heavy metals and metalloids is an important environmental and social problem. The chlorides are one of the serious groundwater contaminants in rural areas. The chlorides are regulated in drinking water quality primarily because excess amounts can cause disease. Chloride in both its gaseous and liquid form can be irritating to the eyes, respiratory tract and skin due to its alkaline nature. Biosorption is one of the biological treatments that has emerged as a new technology for the removal and recovery of metal ions from aqueous solutions which is more environmentally friendly. In this study egg shells and hibiscus biosorbents were used with the intention to removals chlorides ions from synthetic (distill) water. The optimum adsorption capacities of was investigated under pH 6.5 and biosorbents dosage 4.3g at biosorbents concentration, at 90 rpm agitation speed with maximum removal achieved at 1/2 hours. Chloride analysis shows that presence of the heavy metal absorption by Solids and flowers. Every biosorbents had different physical, chemical and biological properties for heavy metals removal by biosorption from the water.*

Keywords*: Chlorides, Biosorption's, Kinetic equilibrium, Isotherm data and Regeneration.*

Sustainable Wastewater Management in Aquaculture: Biofloc Technology Leads the Way

Kola Suneetha, P. Padmavathi*, Darwin Chatla

Aquatic Biology Laboratory, Dept. of Zoology & Aquaculture Acharya Nagarjuna University, A.P, India

**Corresponding Author: suneetha.kola59@gmail.com; padmapin@yahoo.com*

ABSTRACT: *Aquaculture is playing an increasingly important role in meeting the world's growing demand for protein-rich food. To further expand and sustain this industry, both horizontal and vertical expansion are paramount. However, the intensification of aquaculture activities poses significant environmental challenges, especially in the management of wastewater. The conventional approach to addressing this issue involves continuously exchanging water, replacing pond water with fresh, clean water. Unfortunately, this method is unsustainable, as it relies on a constant supply of clean water and does not effectively address the release of pollutant-free water back into the environment. Traditional waste management methods often lead to environmental pollution and pose health risks. Biofloc technology presents a sustainable solution to waste management by harnessing beneficial microorganisms to convert waste into valuable nutrients. In this review, we explore the potential of Biofloc technology in sustainable waste management, outlining its benefits in the aquaculture industry.*

Keywords*: Aquaculture, Biofloc, Sustainability, Waste management, Intensification.*

The Influence of Socio-Economic Factors on Food Waste Utilization and Composting Practices Among Farmers in Asian Agriculture

Bristi Khatun*, Agamutu Pariatamby

Jeffrey Sachs Center on Sustainable, Sunway
Corresponding Author: Bristi.k1111@gmail.com

ABSTRACT: *Food waste is a critical global issue with significant socio-economic and environmental implications, especially in Asian agriculture. Socio-economic differences greatly impact food waste utilization and composting practices among farmers in the region. In the US, 40% of food is wasted annually, costing an estimated $218 billion, or 1.3% of the GDP. To address this, the United States aims to reduce food waste by 50% by 2030. In Malaysia, 17,000 tonnes of food are discarded daily as of 2023. According to the UNEP 2024 report, Japan's food waste amounts to 5.23 million tons, while Bangladesh's food waste reaches 14.10 million tons annually. The global economic cost of food loss and waste is approximately US$1 trillion. In developing countries, food waste during harvest time is often due to inadequate storage facilities on farms, which contribute to pest infestations and cause damage. Many farmers reluctantly let crops rot in the fields due to a lack of access to markets, technology, manpower, and resources to harvest crops. Socio-economic differences significantly impact the acceptance of food waste utilization and composting among farmers in Asian agriculture, shaping sustainable farming practices across the region. In countries such as Malaysia, Bangladesh, and Japan, factors like income levels, education, and access to resources strongly influence farmers' willingness and ability to adopt food waste management and composting techniques. At higher socio-economic levels, 75% of farmers implement efficient food waste utilization and composting practices due to better access to technology, information, and infrastructure. In contrast, only 30% of farmers in lower socio-economic groups adopt these practices, with the remaining 70% facing significant barriers, including limited resources and knowledge. Targeted interventions like educational programs and financial support are needed to bridge socio-economic gaps and promote food waste management and composting. These measures can help enhance agricultural sustainability and address socio-economic disparities in Asia.*

Waste Management and Circular Economy in India

Pooja Sethia*

Oxbridge Business School, India
Corresponding Author: poojasethia71@gmail.com

ABSTRACT: *India is tackling significant waste management issues due to rapid urbanization, industrial growth, and a large population. The traditional 'take, make, dispose' model has led to environmental harm and resource depletion. To counter this, India is increasingly adopting circular economy principles, aiming to reduce waste, enhance resource efficiency, and encourage sustainable consumption and production. Key strategies involve encouraging waste segregation at the source, establishing decentralized waste management systems, and implementing extended producer responsibility (EPR) frameworks. The Swachh Bharat Mission has played a vital role in enhancing sanitation infrastructure and promoting behavioural change among citizens. However, India faces several challenges in implementing these strategies, including inadequate infrastructure, limited technological capabilities, and societal attitudes toward waste. The informal sector is vital in waste management but often operates under unsafe conditions and without social security. Future efforts should focus on enhancing public-private partnerships, investing in innovative technologies, and promoting awareness and education. Ensuring policy coherence, enforcing regulations, and providing financial incentives for sustainable practices are essential to accelerate India's transition to a circular economy. In conclusion, while India faces considerable waste management challenges, adopting a circular economy presents significant opportunities for sustainable development. Overcoming these challenges requires a concerted effort from the government, industry, and society to achieve a cleaner, healthier, and more resource-efficient future for all Indians.*

Enhancing Municipal Wastewater Treatment Efficiency through Innovative MBBR Treatment: A Laboratory Study

Abhilasha G. Deshmukh[1,*], Kiran M. Tajne[2]

[1]PGDT of Electronics and Computer Science, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, India
[2]Government College of Engineering, Mihan Rehabilitation Colony, Khapri Railway Nagpur India
**Corresponding Author: deshmukhabhilasha36@gmail.com*

ABSTRACT: *According to estimates, in less than 20 years, two thirds of the world's population may face a freshwater shortage. The primary factor contributing to this unfavorable future will be the current worldwide scenario of growing water consumption and disposal. The greatest method to preserve the diminishing natural supply is to recycle wastewater effluents from industrial, agricultural, and human activity areas and reuse them to lessen the likelihood of a future fresh water catastrophe. The present study focuses one of the best low-cost sewage treatment methods called as Moving Bed Biological Reactor (MBBR). The study is conducted at existing Sewage Treatment Plant in a Hostel to increase the efficiency of plant. It also mirrors real-world urban wastewater scenarios and employs a comprehensive approach. Important design parameters like Specific Surface area (SFA), Filling ratio (Volume of media/Active Volume of Digester), Hydraulic Retention Time (HRT) are studied through a lab setup. HRT of 6 hr. was found to be giving 87% BOD reduction and 83% COD reduction. Efficiency is improved when filling ratio is increased at 60 % above this BOD and COD was found to be 85% and 79% respectively. Development of the media and the creation of a controlled aerobic environment are pivotal components of the research methodology. In doing so, it has the potential to inform and advance wastewater management practices in urban settings while promoting environmental conservation and healthier urban communities. Above study can be used for improving the performance of existing Sewage treatment plant in the college campus and water can be recycle for gardening and washing purpose.*

Keywords*: Wastewater management, sewage treatment, MBBR method, urban wastewater, environmental conservation, COD, BOD, sustainable practices.*

Agro-Waste to Targeted Theranostic in Triple Negative Breast Cancer: Nanotechnology and Artificial Intelligence Guided Journey

Suvadra Das[1,*], Sankhadeep Chatterjee[2], Urmi Chatterji[3], Partha Roy[4,*]

[1]Basic Science and Humanities Dept., University of Engineering and Management, Kolkata, India
[2]Dept.of Computer Science & Technology, Indian Institute of Engg. Science & Technology, Shibpur, India
[3]Cancer Research Lab, Department of Zoology, University of Calcutta, West Bengal, India.
[4]GITAM School of Pharmacy, GITAM (Deemed to be University), Visakhapatnam, India
**Corresponding Author: suvadra.tech@gmail.com, proy@gitam.edu*

ABSTRACT: *Carbon nanodots have emerged as next-gen clinical arsenals although toxicity worries and sustainable development obstacles still weakens its clinical promise. Present study reports machine learning assisted facile one-pot hydrothermal synthesis of fluorescence carbon nanodots from vegetable peel-waste for theragnostic applications in triple negative breast cancer (TNBC). Artificial Neural Network (ANN) model was pursued to predict influence of carbon nanodot concentration and impact on cell viability. The nanodots (GGCndts) were quasi-spherical of size 4.03 nm with bright blue fluorescence at excitation wavelength of 425 nm. Nanodots was conjugated with epirubicin followed by lactoferrin association (EpiGGCndt) for site-specificity in TNBC. ANN model revealed its accuracy to predict the carbon nanodot concentration and cell viability with an RMSE score of 0.011 and 0.008 respectively confirming its ingenuity. MTT assay of GGCndts in NIH-3T3, MCF-7 and MDA-MB-231 cells revealed no significant cytotoxicity. Same dose of free epirubicin and EpiGGCndt produced enhanced toxicity in both MCF-7 and MDA-MB-231 cells with IC50 of 2µg/ml and 1µg/ml respectively compared to normal cells confirming its biosafety. Speedy permeation in MDA-MB-231 cells was observed within 30 minutes of exposure followed by cellular residence up to 24 hours. Fruits and vegetables are the main stakeholders who account for nearly 50% of worldwide food waste burden. Current work explores waste to wealth approach to provide a sustainable solution to this burning issue with its simultaneous translation into low-toxic targeted theragnostic to tackle complex clinical challenges like TNBCs.*

Innovative Approaches to Sustainable Waste Management: A Global Perspective

O.V.S. Chaitanya*
India
**Corresponding Author: vorugant4@gitam.in*

ABSTRACT: *Sustainable waste management is a critical component of environmental conservation and public health. This research paper explores innovative approaches to sustainable waste management from a global perspective, highlighting the latest technological advancements, policy frameworks, and community-based initiatives that contribute to effective waste reduction and resource recovery. The study begins by examining the current state of waste management practices across different regions, identifying key challenges such as inadequate infrastructure, financial constraints, and varying regulatory environments. The paper then delves into cutting-edge technologies that are revolutionizing waste management, including advanced recycling methods, waste-to-energy conversion, and smart waste collection systems. Case studies from both developed and developing countries illustrate the successful implementation of these technologies, demonstrating their potential to mitigate environmental impacts and promote circular economy principles. Additionally, the research emphasizes the role of policy and governance in fostering sustainable waste management practices. It analyses successful policy interventions, such as extended producer responsibility (EPR) programs and landfill diversion targets, which have been instrumental in driving positive change. Community engagement and education are also explored as vital components of sustainable waste management. The paper showcases grassroots initiatives and public-private partnerships that empower communities to participate actively in waste reduction efforts. By integrating technological innovation, effective policies, and community involvement, the study provides a comprehensive overview of sustainable waste management strategies that can be adapted and scaled globally. The findings underscore the importance of a multifaceted approach to waste management, calling for collaboration between governments, industries, and communities to achieve a sustainable future.*

Interaction amongst Renewable Energy Production, Inflation, Currency Volatility and Trade deficit: a GARCH-TVAR Approach

Raavinuthala Satya Krishna Sharma*, Bethapudi Satyavani
GITAM, HBS, India
**Corresponding Author: sraavinu@gitam.edu*

ABSTRACT: *The major Macroeconomic argument for circular economies and renewable resources has been creating a perpetual supply or low diminishing consumption of resources leading to supply adjusting to the ever-increasing demands with no or very low cost of implications. At least that's what the resources lens of inflation looks at. As a byproduct of such control on inflation alleviation of trade deficit and forex volatility may or may not follow. In a country like India that is largely dependent of imports of crude for its energy needs the study of interaction amongst renewable energy production, inflation, forex volatility and trade deficit shape during times of global conflicts like Russo-Ukraine war is a matter of paramount importance to business as well as economic policy. This work applies Threshold Vector Auto Regression to study the interaction amongst renewable energy production, inflation, forex volatility and trade deficit in regime switching context to capture the impact of changing global scenario on such relations while Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) is used to compute the currency volatility of INR against USD. The work finds that before 2 structural breaks one in January 2020 and the other in September 2020. Before the strike of the pandemic the study sees that increase in renewable energy production augments the growth of USD volatility. During the intense period of first wave of the pandemic between Jan 2020 and September 2020 hike in renewable production growth rates raises the trade deficit gap while arresting the inflation growth. Beyond 2020 growth in renewable energy production reduces volatility and weakly increases trade deficit. Such positive association between renewable energy production and trade deficit is a matter of concern for the exim policy pointing to the need of indigenous technology in renewable energy production. The negative association of forex volatility with renewable energy production acts as a guide to RBI currency management policies. Key Words: Renewable Energy, Inflation, Currency Volatility, Trade Deficit, Structural Breaks.*

Development of Rice Straw Waste-Derived Biochar for the Partial Replacement of Cement to Produce High Strength and Sustainable Concrete

Padmakar Maddala*, Subhash Chandra, Kode Venkata Ramesh
Dept. of Civil Engineering, GITAM School of Technology, GITAM University, Visakhapatnam, AP, India
**Corresponding Author: pmaddala2@gitam.in*

ABSTRACT: *Cement is an important material for building construction or urbanization and is equally responsible for CO2 emissions during its production by cement plants. The present work reports the development of rice straw waste-derived biochar for cement replacement in high-strength concrete. In the present work, the biochar was produced through the pyrolysis of rice straw waste at 800 °C for a duration of 2 hours in a nitrogen-purged furnace. The rice-straw waste derived biochar was characterized using SEM, XRD, FTIR, and aprticle size analyzer to determine its physicochemical properties. The rice-straw waste - derived biochar- was used as a replacement material for the replacement of cement @ 1, 3, 5, and 7 % (w/w) in the casting of cement cubes (15 × 15 × 15 cm size). Results through SEM analysis indicated that the rice straw waste biochar showed a porous structure with the presence of meso and micro pores homogenously distributed on its surface. The XRD analysis showed the presence of two major peaks at 2θ angles of 26.5 ° and 45 ° corresponding to [002] and [100] planes, respectively, showing the presence of graphene like structure in the biochar. Compressive test analysis results indicated that the compressive strength of the cement cubes replaced with rice- straw waste -derived biochar @ 1 and 3 % (w/w) was increased by 7.6 and 8.33 %, respectively at the end of the 28 days of curation as compared to control. However, by increasing replacement percentage up to 5 and 7 % (w/w) it was decreased by 7.6 and 20 %, respectively. Similarly, the flexural strength of the concrete cubes substitued with 1 and 3 % (w/w) biochar was increased by 10.5 and 3.42 %, respectively. Therefore, the incorporation of biochar obtained from rice straw waste not only reduces greenhouse gas emissions but also contributes to the production of durable and environmentally friendly high-strength concrete, which may be used in the creation of sustainable and carbon-negative infrastructure.*

Keywords*: Biochar, Compressive strength, Cement, and Rice Straw Waste*

The Assessment and Policy Solutions for Plastic Microbeads from Personal Care Products in the Indian Market

Riya Kumbukattu Alex[1], Thomas Maes[2], Suja Purushothaman Devipriya[1,*]
[1]School of Environmental Studies, Cochin University of Science and Technology, India
[2]GRID-Arendal, Teaterplassen 3, 4836 Arendal, Norway
**Corresponding Author: devipriyasuja@cusat.ac.in*

ABSTRACT: *Plastic microbeads in personal care products are a significant but often overlooked source of microplastics pollution. These microbeads are included for cleansing, exfoliation, and aesthetic purposes. This study analysed 45 personal care items from the Indian market from different categories like face washes, face scrubs, shower gels, and body scrubs and estimated the abundance, size, colour, shape, and polymer composition of the microbeads. The study used ARIMA (0,2,0) model for emission estimation and future forecasting. Findings revealed that 47% of products contained microplastics, predominantly polyethylene, followed by polypropylene and polystyrene. About 21% contained cellulose microbeads, with uncertain biodegradability. Microbeads identified were mainly irregular and granular, with white/transparent being the most common colour. Average sizes estimated were 640.74µm, 452.45µm, 556.66µm, and 606.30µm across different categories. Annual emissions for 2021 ranged from 2.49×10^{18} to 3.24×10^{19}, with an average of 1.32×10^{19}. Forecasts for 2030 predict emissions between 2.95×10^{18} and 3.82×10^{19}, averaging 1.55×10^{19}. These high values are assumed to be due to India's large population, globalization, inefficient wastewater management, growing economy, and increasing disposable income. The lack of robust policies worsens the issue. The presence of plastics from international brands highlights ongoing transboundary movement. The study underscores the urgent need for stringent policies and effective mitigation measures in India, offering several policy recommendations. Keywords: Microplastic, Pollution, Policy, Microbeads, Personal Care products.*

A Novel Web-Based Tool for Sustainable and Integrated Municipal Solid Waste Management Facilities in India

Rakesh Tejavath[1,2], Ajay Kothari[3], Manogna Reddy[2], Brajesh K Dubey[1], Subhankar Karmakar[3], Vinay Yadav[2,*]

[1]Environmental Engineering and Management, Dept. of Civil Engineering, Indian Institute of Technology Kharagpur, India
[2]Vinod Gupta School of Management, Indian Institute of Technology Kharagpur, India
[3]Environmental Science and Engineering Dept, Indian Institute of Technology Bombay, Mumbai, India
**Corresponding Author: vinay@vgsom.iitkgp.ac.in*

ABSTRACT: *The efficient management of municipal solid waste (MSW) is critical for municipalities and municipal solid waste management (MSWM) authorities, necessitating innovative approaches to reduce MSW and optimising its processing and treatment before final disposal. Urban municipalities in India experience substantial issues addressing MSW due to high population, inadequate infrastructure, inefficiencies in the collection, expensive transportation, and lack of awareness of MSWM rules. Effective MSWM is vital for confronting public health and environmental threats, as well as accomplishing sustainable development. It necessitates a smart solution that can make precise suggestions for MSWM while considering local and existing criteria. The present work proposes a novel web-based tool that aims to assist municipalities and MSWM authorities in making robust decisions about managing a variety of MSW streams efficiently. The tool is structured on a framework that integrates centralised and decentralised solid waste facilities for processing and incorporates updated MSWM regulations. The tool promotes effective and sustainable waste management strategies by favouring decentralised management everywhere possible and relying on centralised facilities for the last part to enhance resource recovery, therefore minimising social and environmental impacts. The tool assists users in determining the most appropriate solid waste management system for their specific area by considering the classification of MSW, existing systems, efficiency, and other pertinent economic aspects. This work offers a major leap forward in solid waste management, offering realistic and adaptive solutions for urban planners, municipal governments, and MSWM consultants. Furthermore, the online tool has the potential for improvement, such as cost estimation and design aspects, to provide extensive management and execution support. It could eventually minimize waste reaching the final disposal system.*

Keywords*: Solid Waste Management Tool, MSW Management Web Application, Municipal Solid Waste Management, Integrated Solid Waste Management System.*

Waste to Wealth with Bio-Remediation

Heeral (Bhalla) Singh[1,*], Swathi Chikkala[2], Surekha Patnaik[3]

[1]Conserve Water care Pvt Ltd., India
[2]Department of English & Other Languages, School of Humanities & Social Sciences, GITAM (Deemed to be University), Visakhapatnam, India
[3]Arohan Tribal Society, Registered NGO, Visakhapatnam, India
**Corresponding Author: schikkal@gitam.edu*

ABSTRACT: *An Ecological System's approach to Pollution Control is necessary to take care of the deleterious effects that any disturbance could possibly have on the equilibrium between the two components of the environment, namely, the living and the non-living. Recently interest has been shown in the development of eco-friendly novel processes that are based on the utilization of biological systems. One such system involves the culture of earthworms (vermiculture) for the stabilization of a variety of organic solid wastes (vermicomposting). The scope and potential for recycling of a variety of waste is vast. This recycling can bring appreciable benefits to society. In addition, there are benefits of a cleaner environment and a healthier habitat. Once waste is recycled or made use of, it becomes a valuable resource. The present paper will elaborate on the unique technology developed and solely owned by Conserve. One of the key areas in this field, realized and being promoted world over, is the remediation of Kitchen / Canteen / Garden / Farm Organic Wastes, by the use of Vermicomposting Technology to produce Organic Manure, and reaping thereby much more than just the fruit of benefits of eco-friendly handling of such wastes.*

Behavioural Changes in Household Solid Waste Management Through Social Entrepreneurship

Satya Vani Bethapudi[1,*], Raavinuthala Satya Krishna Sharma[2]
[1]Department of Entrepreneurship, School of Business, GITAM, Hyderabad, India
[2]Department of Accounting and Finance, School of Business, GITAM, Hyderabad, India
**Corresponding Author: sbethapu2@gitam.edu*

ABSTRACT: *Despite moving forward towards development in every sphere of life, modern societies are yet to attain a congruence in environmentally valued household waste management behaviours with the help of enterprises. Statistical facts reveal that the pace of accumulation of household solid waste is multifold faster than the practices being followed by the Governmental agencies or private enterprises in dealing with household waste. The resources in terms of technology, finance, people, size and scope of activities, fall deficit in attaining the objective of household waste management, ending up with inefficient coverage, inefficient collection and improper disposal. Social Entrepreneurship can bring behavioural changes in the society in a culturally acceptable, technologically feasible, environmentally favourable and above all, economically profitable manner. Role of entrepreneurs in household waste management system becomes crucial in building salubrious societies to mankind.*

The primary objective of this research paper is to identify a behavioural change, in the households of a gated community, prior and after the intervention of a waste management enterprise. This research would act as a pilot study to the researchers in moving forward for a greater cause of their contribution towards environmental development, by an in-depth analysis for Social Entrepreneurship opportunities, in the area of waste management. Purposive convenient sampling technique was used to identify a sample size of 250 residents in a gated community in the city of Hyderabad. The primary data was collected by distributing a questionnaire to the households inquiring about their waste segregation and disposal methods before and after the intervention of a waste management entretprise in the community. Behavioural changes were captured and analysed accordingly. The results strongly ascertained a change in the practice of waste management along with developing a positive attitude towards their individual contribution for sustainable environmental development. The negative side was evident in the very low percentage of community population in maintaining a consistency in their behavioural change.

Keywords*: Waste Management, Social Entrepreneurship, Environmental Development, Behavioural Change.*

Policy-Relevant Insights on Greenhouse Gas Emissions from Municipal Solid Waste Management: A Case Study of Warangal

Baby Keerthi Thirunagari[1,*], Gummadivalli Shiva Kumar[2], Animi Poornima[3], Sumanth Chinthala[4]

[1]Department of Civil Engineering, Indian Institute of Technology Delhi, Delhi, India
[2]Department of Life and Environmental Sciences, College of Natural and Health Sciences (CNHS), Zayed University, Abu Dhabi, UAE
[3]School of Law, GITAM (Deemed to be) University, Andhra Pradesh, India
[4]Department of Civil Engineering, National Institute of Technology, Warangal, India

**Corresponding Author: keerthi6b@gmail.com*

ABSTRACT: *Rapid urbanization, accelerating economic growth, and evolving consumption and waste-generation patterns necessitate an urgent revision of municipal solid waste management (MSWM) policies. In addition to minimizing cost and exposure risk, these policies must prioritize the prevention/mitigation of greenhouse gas (GHG) emissions from MSW, with a particular emphasis on carbon dioxide, methane, and nitrous oxide. Though it was recorded across literature that the majority of MSW GHG emissions result from its organic fraction (OF), numerous urban local bodies (ULBs) of India dispose of unsegregated MSW. Additionally, MSW treatment technologies in many ULBs are not integrated, thus, resulting in the release of mitigatable GHG emissions. Further, several MSW disposal mechanisms that have lower GHG footprint compared to open dumping are not considered by several Indian ULBs. This need for the upgradation of existing policy and implementation framework is exemplified in the current article by considering the city of Warangal as a case study. The GHG emissions are calculated for various MSW treatment and disposal scenarios for the year 2025, using IPCC tier-1 methodology. Additionally, the GHG emissions from MSW collection and transportation are assessed. Various scenarios include (S1) Baseline scenario (most MSW landfilled); (S2) Segregation followed by composting of MSW OF; (S3) Segregation followed by anaerobic digestion of MSW OF; and (S4) Integrated management (segregation, recycling, composting, and landfilling). The results reveal that, in scenario S1, GHG emissions from Warangal's MSW will be 460.31 kilotons of CO2 equivalent per year in 2025. The integrated MSW management scenario (S4), which combines many technologies, showed the greatest potential for reducing GHG emissions, with an emission reduction benefit of 80.72% compared to scenario S1. The findings of this study will aid the government in decision-making for effective MSWM, particularly in the context of GHG emission reduction objectives.*

Keywords*: Waste Management, Emissions Assessment, GHG, Case Study Analysis, Sustainability.*

Advance Sensitivity Analysis of Waste Plastic Gasification for Syngas Production

M. Enayati, M. Ebrahimzadeh Sarvestani, H. Safarzadeh, E. Ebrahimzadehsarvestani, F. Di Maria*

LAR5 Laboratory, Department of Engineering, University of Perugia, Perugia, Italy

**Corresponding Author: francesco.dimaria@unipg.it*

ABSTRACT: *Efficient recycling systems are crucial for sustainable plastic management. Landfilling risks odors, contaminants, and toxins, while incineration harms the environment and public health. Adopting circular economy principles enhances plastic waste management through increased recycling. Gasification, a thermochemical process, converts waste plastic into syngas (CO, H2, CH4, and light hydrocarbons). Syngas can be used for heat, energy, electricity generation, and transportation fuels via Fischer-Tropsch and methanol-to-gasoline processes. The study examines a feed composition of LDPE, HDPE, PP, PS, PET, and PVC with respective weight percentages of 15%, 15%, 30%, 13%, 13%, and 14%. Operational conditions are set at 15°C and 1 barg pressure, with a base flow rate of 1000 kg/hr. The mixture is initially crushed to a 4 mm particle size before processing into elemental components in the Yield reactor. Separation processes remove ash and chloric (Cl) components, preparing the feed for the R-Gibs Gasifier. Here, steam and feed in a 1.7 ratio undergo gasification at 700°C under 1 atmosphere. The resulting product stream is cooled, and using a two-phase separator and pressure swing adsorption, a mixture of hydrogen and carbon dioxide is produced. Simulation results indicate that introducing 1700 kg/hr of steam can generate 1216 kg/hr of syngas. In the sensitivity analysis, each parameter was adjusted individually. This section examines how gasifier temperature, pressure, steam flow, and feed particle size affect hydrogen and carbon monoxide production as syngas. Raising the gasifier temperature increases the mole fraction of H2 and CO. Higher feed gas pressure decreases the conversion rate. Increasing steam flow boosts syngas production.*

Keywords*: Plastic recycling, Circular economy, Syngas production, Sensitivity analysis, Environmental impact, Sustainable management.*

Implementing Circular Economy in Healthcare Waste: Technological Innovations and Process Management

E. Ebrahimzadehsarvestani, M. Ebrahimzadeh Sarvestani, H. Safarzadeh, M. Enayati, F. Di Maria*

LAR5 Laboratory, Department of Engineering, University of Perugia, Perugia, Italy

**Corresponding Author: francesco.dimaria@unipg.it*

ABSTRACT: *Ineffective healthcare waste (HCW) management poses significant risks to the environment, human health, and socio-economic sustainability due to the infectious and hazardous nature of HCW. This research aims to provide a comprehensive overview of HCW management by mapping the scientific development of HCW research, identifying prominent research themes and trends, and establishing a research agenda for transitioning towards a circular economy (CE) and achieving a sustainable environment. The analysis revealed several key HCW research themes, such as the minimization of HCW, sustainable management practices, and policy-making. Additionally, it highlighted the environmental impacts of HCW incineration, which include air pollution and toxic residue. The study also examined the management of hazardous HCW, emphasizing the need for effective segregation, treatment, and disposal methods. Furthermore, the importance of proper HCW handling and occupational safety and training for healthcare workers was underscored to prevent exposure to harmful substances and reduce health risks. Despite the healthcare industry's potential to contribute to the circular economy (CE) transition, it has been largely overlooked in CE discourse due to the prevalent single-use mindset driven by the infectious, toxic, and hazardous nature of HCW streams. This study illuminates the healthcare waste (HCW) management domain by uncovering the current status of HCW research, highlighting existing gaps and challenges, and proposing potential avenues for further research. The findings suggest that future efforts should focus on developing innovative technologies and processes for HCW treatment, enhancing regulatory frameworks, and promoting awareness and education among stakeholders to facilitate a CE transition in healthcare industry HCW management.*

Keywords*: healthcare waste, circular economy, sustainable management, hazardous waste, environmental impacts, policy-making, occupational safety, HCW minimization.*

Recycling Methods and Environmental Impact of Batteries in Electric and Internal Combustion Vehicles

H. Safarzadeh, M. Ebrahimzadeh Sarvestani, M. Enayati, E. Ebrahimzadehsarvestani, F. Di Maria*

LAR5 Laboratory, Department of Engineering, University of Perugia, Via G. Duranti 93,06125, Perugia, Italy

**Corresponding Author: francesco.dimaria@unipg.it*

ABSTRACT: *The environmental cycle problem of removing worn-out batteries of both internal combustion and electric cars in the plan of replacing internal combustion cars with electric ones is one of the most important challenges for the sector industry and for researchers. The production methods of primary and secondary batteries are very different from each other, so their recycling methods are also different from each other. Battery recycling is an activity aimed to reduce the number of batteries that are disposed of as waste in line with the implementation of circular economy concepts. Batteries contain several heavy metals and toxic chemicals, and their disposal by the same process as conventional waste raised concerns about the pollution of soil and, water along with concerns on human health. While reducing the amounts of pollutants released through disposal by landfilling and/or incineration, battery recycling can facilitate the release of harmful substances from batteries to the environment and the workers involved in recycling operations. Various methods have been developed to dispose of batteries, each one characterized by specific advantages but also drawbacks, but in any case able to reduce the amount of new battery produced through their recycling and reuse. Specific materials used for the batteries construction, like rare earth, are considered critical in the supply chain. Nowadays most of the research focuses on recycling and recovery-related issues, and policy and regulatory affairs have received less attention than recycling. In this research, an attempt has been made to examine the different types of batteries and their recycling methods and the advantages and disadvantages of these methods on the environment.*

Keywords*: Battery recycling, Electric vehicles, pollution, Internal combustion car, Sustainable management.*

Bridging the Knowledge Gap: Indian Farmers' Awareness, Attitude and Opinion on Microplastic Pollution in Agroecosystem

Abhinab Borah[1], Suja Purushothaman Devipriya[1,*], Suja Purushothaman Devipriya[2]
[1]Scholar, School of Environmental Studies, Cochin University of Science and Technology, Kochi, India
[2]School of Environmental Studies, Cochin University of Science and Technology, Kochi, India
**Corresponding Author: abhinobborah9@gmail.com*

ABSTRACT: *Microplastics have been detected in various agricultural environments, affecting soil, crops, and sometimes livestock. There is increasing agreement that plastics and microplastics pose a significant threat to agricultural productivity and food safety, impacting both environmental health and the food chain. However, no effective technical solutions currently exist to tackle microplastic pollution in agriculture. Understanding farmers' preferences and practices is vital for reducing microplastic contamination. This study examines the awareness, attitudes, and opinions of Indian farmers concerning microplastic pollution. A random sampling method was employed to select 310 crop farmers from diverse regions of India. The survey assessed farmers' knowledge, practices, and perceptions related to microplastic pollution using both quantitative and qualitative methods. The results highlight a troubling lack of awareness about microplastics, with only 33.5% of respondents having prior knowledge and 66.5% being unaware of microplastic pollution. Random forest analysis identified education as the most significant predictor of farmers' awareness and attitudes toward microplastic pollution, followed by age and gender. 61.3% of farmers rely on plastics for efficiency, yet only 21.6% have measures to reduce plastic pollution. Attitudinally, 74.8% of farmers expressed significant concern about plastic pollution's impact on agriculture and health. In terms of opinion, 90% of respondents showed strong interest in learning how to reduce microplastic pollution. The findings underscore the urgent need for targeted educational programs and policy interventions to bridge knowledge gaps and promote sustainable practices, ultimately reducing the environmental footprint of agriculture in India. Keywords: Indian farmers, microplastic pollution, farmers awareness, attitude and perception.*

Keywords*: Indian farmers, microplastic pollution, farmers awareness, attitude and perception.*

Techno-economic Feasibility Analysis of a Proposed Bio-methanation Plant in the city of Bilaspur, Chhattisgarh: A Sustainable Approach to Organic Waste Management

A. Sharma*, S. Shekhar
Department of Civil Engineering, NIT Raipur, Raipur, India
**Corresponding Author: sharmaaparna.iitd@gmail.com*

ABSTRACT: *Solid Waste Management (SWM) has become a prominent and unavoidable issue for nearly all municipal bodies in India. The field encompasses the regulation of the generation, collection, storage, transfer, processing, and disposal of both organic and inorganic waste. SWM demands substantial resources from civic bodies, yet only a few in the country manage the system effectively. As part of the "Swachh Bharat Mission," an initiative by the Indian government, all corporations were urged to actively participate. However, there is still significant work to be done in this area. Urban Local Bodies in India face challenges in managing the large volumes of organic waste. Given that a significant portion of Indian municipal solid waste is biodegradable, it is essential to adopt sustainable practices such as composting and bio-methanation. This study explores the feasibility of a proposed bio-methanation plant in the city of Bilaspur, Chhattisgarh. Bio-methanation provides a safe method for processing biodegradable waste by generating energy and preventing the emission of toxic pollutants. The process produces valuable byproducts like biogas and bio-slurry. The study addresses the technical and economic aspects of the project, as well as its environmental and social implications. A risk analysis was also conducted to identify and mitigate potential risks. The findings suggest that bio-methanation is both environmentally and economically sustainable for managing organic waste in Bilaspur, where more than 50% of the waste is organic.*

Keywords*: Solid Waste Management, Swachh Bharat Mission, Organic waste, Bio-methanation, Feasibility analysis*

Intelli Waste: IoT and QR Code Enhanced Cyber-Secure Waste Management

Nishigandha Vyawahare*, Atharva Atkari, Smit Datir, Sakshi Pawar

Dept. of Cyber Security, G H Raisoni College of Engineering and Management (Affiliated to SPPU), Pune, India

**Corresponding Author: nishigandha.vyawahare@rasioni.net*

ABSTRACT: *The issue of solid waste management is paramount in urban and rural areas worldwide. Therefore, we propose an innovative waste management system leveraging IoT sensors, QR code technology, and advanced cybersecurity measures to enhance the efficiency and accountability of garbage collection processes. The system integrates a mobile application accessible by users and garbage collectors, each with specific rolebased functionalities. QR codes displayed on each household's door/dustbins will be scanned by garbage collectors to confirm collection, triggering real-time notifications to users and administrators. Additionally, IoT sensors on public area dustbins will detect when garbage is full and notify the admin to avoid overflow. A secure payment system will facilitate fines for noncompliance with waste segregation rules. The integration of various encryption algorithms guarantees the secure transmission and storage of sensitive data. Moreover, a geotagging feature will enable users to report dead animals, helping locate and address such issues promptly. This comprehensive approach not only streamlines waste management operations but also enforces segregation compliance, contributing promoting a cleaner and more sustainable urban environment.*

Keywords*: Trash Management, IoT Sensors, QR Code, Cybersecurity, Real-time Notification, SHA 256, Role-based Access, Sustainability, Geotagging.*

Assessing the Influence of Visiting Academicians on Student Empowerment and Sustainable Entrepreneurship in Private Universities in Northwest Nigeria

Aliyu Mohammed*

Nigeria

**Corresponding Author: aliyu.mohammed@sun.edu.ng*

ABSTRACT: *This research work provides a new framework to unleash agriculture in Nigeria through addressing some key challenges by involving empowered trained youths and local government support. Nevertheless, Nigeria seems to suffer from major challenges, which are high post-harvest losses, inadequate infrastructure, and unreliable power supply for mechanized farming, as well as youth unemployment which reduces their direct participation in agriculture. These are some of the challenges that negatively affect agricultural output, food sufficiency, and rural advancement. These barriers are described in detail in this research, and the use of qualitative approaches such as a review of the literature and cases studies successfully provides methods to overcome these obstacles. Major conclusions depict the necessity of the upgrades in the postharvest handling of crops, the availability and stability of electric power for high tech in agriculture, the agricultural literacy with the help of vocation training for youngsters in agriculture, and the increased authorities' participation based on local capabilities and requirements. Thus, the concerns and outcomes identified in the study relate not only to agriculture but also encompass other elements of economic and social development. The proposed strategies could be useful for improving of condition in food security, for receiving new workplaces by young persons, and for stimulation of economic development in rural regions. Thus, through promoting sustainable agriculture and integrating youths on the agricultural value chain, the study also has the potential of creating employable and food self-sufficient youths to counteract climate change. The policy integration suggested by this research will help change the agriculture sector so that it offers the youth higher chances. At the end, it focuses on the call to action for the government and private firms to adopt these strategies in support of sustainable agriculture in the long run.*

Keywords*: Visiting Academicians, Student Empowerment, Sustainable Entrepreneurship, Private Universities, Northwest Nigeria.*

An Emphatical Study on Post Implementation Analysis of GST in Asian Paints Company

M.S. Vijayakumar[1,*], K. Lingaraj[2]

[1]G.T.N. Arts and Science College, Dindigul, India
[2]Department of Business Administration Thiagarajar College, Madurai, India
**Corresponding Author: vijayakumar subramanian*

ABSTRACT: *GST has started in India by passing a long way. Most of the countries in the world are now under this system. There is a need for a new one-country tax system to free India from many taxes and rate system. GST will greatly help to overcome economic confusion caused by the complex tax structure and help in the development of general national markets. It is expected that all sectors of economy such as industry, business, government departments and services sectors have to bear its positive impact. Introduction of the Value Added Tax (VAT) at the Central and the State level has been considered to be a major step – an important step forward – in the globe of indirect tax reforms in India. If the VAT is a major improvement over the pre-existing Central excise duty at the national level and the sales tax system at the State level, then the Goods and Services Tax (GST) will indeed be an additional important perfection – the next logical step – towards a widespread indirect tax reforms in the country. Initially, it was conceptualized that there would be a national level goods and services tax, however, with the release of First. The researcher in this paper study about positive impact of introduction of GST in Asian Paints for twenty years and has approached this study based on financial statements of the Asian paints for twenty years.*

Keywords*: GST , VAT, one tax, ratios, reforms, positive impact.*

Sustainable Waste Management and Circular Economy: Analysing the Impact of Fiscal Policy on Sectorial Growth in Sub-Saharan Africa

Silas Iliya Yerima*, Nabila Khalid Datti

Economics, Skyline University Nigeria, Kano State, Nigeria
**Corresponding Author: silasyerima@yahoo.com*

ABSTRACT: *Sustainable waste management and the circular economy present significant opportunities for fostering economic growth and environmental sustainability in Sub-Saharan Africa. This conceptual paper explores the impact of fiscal policies on the growth of the waste management sector within this region. The genesis of the problem lies in the burgeoning waste generation and the inadequate waste management infrastructure, which poses severe environmental and public health challenges. The overall objective of the study is to assess how fiscal policies can drive sectorial growth in sustainable waste management and promote a circular economy. The research investigates key issues, including the effectiveness of current fiscal policies, the barriers to implementing sustainable practices, and the potential economic benefits of adopting a circular economy approach. The methodology involves an extensive review of secondary data, including literature from academic journals, books, newspapers, and historical documents, to identify trends, challenges, and opportunities within the sector. The analysis reveals that effective fiscal policies, such as tax incentives, subsidies, and public-private partnerships, significantly contribute to the growth of sustainable waste management practices. However, findings also indicate challenges such as policy inconsistency, lack of infrastructure, and insufficient public awareness. The paper recommends comprehensive fiscal reforms, increased investment in waste management infrastructure, and enhanced public education to promote sustainable practices. The conclusion highlights the potential of fiscal policies to drive sectorial growth, although limitations such as data scarcity and varying economic conditions across the region warrant further research.*

Keywords*: Sustainable Waste Management, Circular Economy, Fiscal Policy, Sectorial Growth, Sub-Saharan Africa.*

Economic Implications of Blockchain Technology for Sickle Cell Anemia Data Management and Waste Management in Kano State

Trimisiyu Omotayo Lawal*, Sa'ada Misbahu Zubair
Dept. of Economics, Skyline University Nigeria, Kano State, Nigeria
**Corresponding Author: trimisiyu.lawal@sun.edu.ng*

ABSTRACT: *Blockchain technology integration into data management systems is a revolutionary technique, especially when it comes to solving important problems like waste management in Kano State, Nigeria, and sickle cell anemia. This conceptual study examines the economic effects of blockchain technology in these two crucial areas. The insufficiencies in waste management systems and inefficiencies in the healthcare sector about people with sickle cell anemia are the underlying causes of the issue. The main goal of this study is to determine how blockchain technology may improve data integrity, reduce costs, and increase transparency in these domains. The study problem involves examining the financial effects of blockchain technology on waste management and healthcare data management systems. The study's methodology involves an evaluation of secondary data, which includes books, newspapers, academic journals, historical documents, and literature. According to the report, blockchain technology can completely transform data management by guaranteeing clear, secure, and immutable records. This would lower administrative expenses and improve patient care. Similarly, blockchain has the potential to optimize resource allocation, measure improvements, and streamline operations in waste management. Important studies indicate that blockchain can improve resource management in both industries while reducing operating costs and increasing efficiency. One of the recommendations is to use blockchain technology to improve data security and streamline waste management procedures. The research findings indicate that although blockchain presents noteworthy financial advantages, its implementation may encounter obstacles like technological assimilation and upfront costs. The study's limitations include the use of secondary data and the need for additional empirical investigation.*

Keywords*: Blockchain Technology, Sickle Cell Anemia, Waste Management, Economic Implications, Kano State.*

Beyond Closure: Contaminant Transport and Health Risks from Vilappilsala Landfill

Amala Jaison*, Indulekha K P
Civil Engineering Department, College of Engineering Trivandrum, Kerala, India
**Corresponding Author: amalajude57@gmail.com*

ABSTRACT: *The Vilappilsala landfill, despite closure in 2009, continues to contaminate the environment and pose significant health risks due to ongoing leachate production. While previous studies have focused on specific aspects of landfill impacts, a comprehensive understanding of the complex interplay between leachate, groundwater, surface water, human health, and the environment in the context of Vilappilsala remains limited. This study addresses these critical knowledge gaps by comprehensively characterizing the landfill's impacts through contaminant analysis, transport modeling, and human health risk assessment. By analyzing leachate, groundwater, surface water, and local plants for contaminants, including emerging pollutants and microplastics, the study identifies contamination sources and pathways. A hydrogeological model utilizing OpenGeoSys, FEFLOW, and MODFLOW simulates contaminant transport, including potential impacts on the foundation of the Sree Padmanabhaswamy Temple. To assess human health risks, disease patterns are analyzed, and potential links to landfill contaminants are explored. Additionally, the study examines the landfill's impact on land use and groundwater levels. Findings from this research will inform effective remediation strategies and contribute to sustainable landfill management practices.*

Keywords*: landfill, leachate, contaminants, human health, environmental impact.*

Smart Bin: IoT-based Waste Management

Shain*

**Corresponding Author: shainziyona@gmail.com*

ABSTRACT: *In today's world, waste management is an issue that is of growing concern. With advancing technology and increasing population, the consumption and waste generation have also increased. A healthy environment, high standards of living, and solid waste management are all closely related. Trash cans positioned in public spaces are overflowing in numerous cities across the world, a sign of their impending inefficiency. Solid waste management is an essential procedure that affects all aspects of the economy, standard of living, healthcare, education, and way of life. The goal of efficient solid waste management is to reduce any negative impacts on the areas listed above. The absence of a legislative framework pertaining to waste management, including waste recycling requirements, has made garbage collection and segregation extremely difficult. Additionally, poor and inefficient collection methods create unpleasant conditions that pose a risk to the local populations' environment. These overfilled trash cans provide a haven for insects and other rodents, which accelerates the spread of diseases. A novel method of solid waste management is proposed in this paper using ESP32 microcontroller along with other peripherals. The waste levels are monitored by the Blynk IoT mobile application. The system also notifies when the trash is full and has to be emptied. Additionally, the system triggers an alert mechanism to notify users of potential concerns.*

Keywords*:*

Sustainable Waste Management Practices of select Companies in India: An Analysis of Disclosures within Integrated Reports

P. Santhi*, P. Sasirekha, J. Anija

Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India

**Corresponding Author: shanthi_comm@avinuty.ac.in*

ABSTRACT: *The business is becoming highly transparent on their practices. Disclosures on waste management is one of its kind in their Integrated Annual Report. Vast majority of the reports carry the initiatives on wate management either with the aim of deriving benefit from good solid waste management practices or circular economy strategies or purely to enhance a corporate image. The principles of circular economy extend beyond traditional waste management. It enhancement practices of reuse, refurbishment, remanufacture, recycling and repurposing resources from products at the end of their life cycle back as raw material inputs to create new products to emphasize on improved design and production practices to eliminate waste. The aim of the study is to analysis the disclosures on waste generated, recovered, strategic approaches to reduce waste and the compliance of SDGs by the select manufacturing companies in India for the period 2019-20 to 2023-24. The secondary data were enumerated from the disclosures in the Integrated Annual Reports of 53 companies using content analysis. Descriptive statistics, ANOVA and Visualization techniques were used to process the data. Though there are surface challenges to adopting circular economy principles, this article presents the quantitative measures and strategic approach of companies on the path of maximizing the value of corporate waste streams.*

Keywords*: Circular economy, Waste Generation and Recovery, Waste Reduction Strategies, Value out of Waste, Manufacturing Sector, SDGs.*

Leverage IoT Technology for Waste Management and Sustainable Initiatives

Amol Jaiswal[1,*], Shree Charan C[2]

[1]Gitam School of Business, Hyderabad Campus, India
[2]Gitam, HBS, Hyderabad, India

**Corresponding Author: ajaiswal2@gitam.in*

ABSTRACT: *In an era of rapid urbanization and environmental challenges, the integration of Internet of Things (IoT) technology into waste management systems represents a transformative approach to enhancing sustainability and operational efficiency. This paper would explores the role of IoT in modern waste management, focusing on its potential to optimize waste collection, reduce environmental impact, and promote sustainable practices. By connecting smart sensors, real-time data analytics, and automated systems, IoT enables precise monitoring of waste levels, dynamic route optimization for waste collection vehicles, and early detection of maintenance needs. These innovations not only reduce operational costs but also minimize carbon footprints by lowering fuel consumption and emissions. The paper will also include the case studies of successful IoT-enabled waste management initiatives in urban settings, illustrating how data-driven strategies can be scaled to address the complex demands of smart cities. Additionally, the role of IoT in facilitating recycling and waste segregation at the source is examined, highlighting its contribution to circular economy principles. Challenges such as data security, privacy concerns, and the need for robust infrastructure are also addressed, offering a balanced view of the opportunities and obstacles in leveraging IoT for waste management. In conclusion, this paper proposes the IoT technology as a crucial enabler of sustainable waste management practices. Its adoption not only fosters efficiency but also aligns with global sustainability goals, paving the way for smarter, greener cities. Future research directions are proposed, including the exploration of advanced AI integration and the expansion of IoT applications in rural and underserved regions.*

Keywords*: IoT, Waste Management, Sustainability.*

Developing an Adaptive Waste Management System for India: Integrating Hybrid Multi-Criteria Decision-Making Approaches

Manindra Rajak, Doddigallu Naga Chandra Teja*

GITAM (Deemed to be University) Bengaluru, India

**Corresponding Author: ndoddiga@student.gitam.edu*

ABSTRACT: *India, the second most populous country in the world, faces significant challenges in managing municipal solid waste (MSW) due to rapid urbanization, industrial growth and increasing population density. With the country's waste generation projected to grow exponentially, Traditional methods, such as landfilling and incineration, are becoming increasingly unsustainable due to limited land availability, environmental pollution, and public health risks. The challenges are further compounded by the country's vast cultural, geographical, and socio-economic diversity. Different regions within India exhibit varying waste compositions, climate conditions, and socio-economic profiles, necessitating tailored waste management strategies. For instance, rural areas may prioritize composting and recycling due to the predominance of organic waste.*
In contrast, urban areas may require advanced technologies like anaerobic digestion or gasification to handle mixed waste streams effectively. The recent advancements in the Multi-Criteria Decision-Making (MCDM) method offer a promising approach to addressing the challenges. This allows for the systematic evolution of multiple criteria-economic, social and environmental enabling more balanced and informed decision-making. The proposed system will provide policymakers with a robust tool to address the complexities of waste management in different regions across India.

Keywords*: Waste Management, Multi-Criteria Decision Making (MCDM), Sustainability, Technology Selection, Cultural Adaptation.*

Model for optimising Municipal waste collection: Case study of Calicut City

Amritha P K[1,*], Neethu Lal[2], Dhanusree M[3]
Project Associate, Dept. of Architecture and Planning, National Institute of Technology Calicut, India
**Corresponding Author: amrithapk@nitc.ac.in*

ABSTRACT: *In most of the cities in India there are no designated spaces for collection and recovery, or if they have designated some space for it, the allotted space is not enough for the quantum of waste brought to that particular area. Moreover, the lack of quality and efficiency in waste collection services in terms of inadequate human resources, their frequency in collection services, inadequate designated areas for storage of collected waste, lack of facilities including physical infrastructure, and improper route planning leaves a gap for devising a more optimised solution for waste collection in cities. This research considers Calicut Municipal corporation as the study area as there is no systematic approach in the collection of Municipal solid waste. The study tries to have optimal locations for a common sorting centre in each ward. The criteria for this were selected based on literature reviews and stakeholder surveys done and helped in ensuring a comprehensive understanding of the practical requirements and expectations. Preference of each criterion identified relative to rest of the criteria was expressed by assigning weights and each criterion was mapped to visualize and evaluate the suitability of different areas within the city. After determining the locations, an optimal routing was done by reducing the transportation time of the collected waste from the sorting points and then testing its correctness by comparing it with the current routes taken. The findings of this research work can be helping the municipalities or private recycling agencies for establishing sorting points and managing the waste transportation by utilizing the optimal routes identified in the study. By improving the collection system, the work will positively affect all stages of waste management.*

Keywords*: Municipal waste, collection, sorting, locations, waste management.*

Waste Management in India: Navigating Hindrances and Opportunities

Swati Yadav*
Mangalayatan University, Aligarh, India
**Corresponding Author: 20241813_swati@mangalayatan.edu.in*

ABSTRACT: *This paper investigates the current state of waste management in India, highlighting the challenges faced and exploring opportunities for sustainable practices. The study uses a mixed-methods approach, combining a review of existing literature and policy documents with qualitative analysis of key stakeholders in the waste management sector. This approach helps to identify the primary barriers and potential solutions for effective waste management in India. The research identifies several significant challenges in India's waste management system, including low waste collection rates, widespread open dumping, and inadequate recycling infrastructure. The informal sector dominates recycling activities, often operating under unsafe conditions without sufficient regulation or support. However, the study also highlights potential opportunities for improvement, such as enhancing public awareness, investing in modern waste processing technologies, and promoting formalization and better regulation of the recycling sector. Effective waste management in India requires a multifaceted strategy involving policy reform, infrastructure development, and community engagement. Policymakers and stakeholders need to address existing barriers and leverage opportunities for sustainable practices to mitigate environmental impacts and promote public health. This paper will provide a comprehensive overview of the waste management challenges in India while offering actionable insights and strategies for overcoming these obstacles. It contributes to the on-going discourse on sustainable waste management by highlighting the unique context and complexities of the Indian scenario.*

Keywords*: Waste Management, Sustainable Practices, Recycling Infrastructure, Policy Reform, Environmental Impact.*

Waste Management: Net Zero Economy, Sustainable Packaging etc.

Vanishree R*
School of Law Presidency University, Rajankunte, Yelhanka, Bengaluru, India
**Corresponding Author: vanishree.r79@gmail.com*

ABSTRACT: *As the global community strives towards achieving a net-zero economy, the management of waste and the development of sustainable packaging solutions have become crucial components of environmental and economic strategies. This paper examines the pivotal role waste management plays in supporting the transition to a circular economy, focusing on how it can contribute to reducing greenhouse gas emissions and promoting resource efficiency. In the context of a net-zero economy, the traditional linear model of production and consumption, which emphasizes the "take-make-dispose" approach, is no longer viable. Instead, circular economy models that prioritize reusing, recycling, and reducing waste are essential to minimizing environmental impact and maximizing resource recovery The paper explores the growing demand for sustainable packaging, addressing both the challenges and opportunities presented by innovative materials and technologies. Key trends in packaging—such as the use of compostable materials, the shift from single-use plastics to reusable alternatives, and advancements in material efficiency—are analyzed in detail. The role of extended producer responsibility (EPR) schemes, government regulations, and international standards is also discussed, highlighting how policy frameworks can drive both industry innovation and consumer behaviour change towards more sustainable practices.In addition, the research highlights case studies from various industries and regions, demonstrating successful implementations of waste management practices and sustainable packaging. These examples offer insight into the scalability of such solutions and the potential for cross-sector collaboration to achieve long-term sustainability goals. The paper concludes by emphasizing the need for integrated, multi-stakeholder approaches to align waste management practices with the broader objectives of a net-zero economy, underscoring the importance of innovation, regulation, and public-private partnerships in driving systemic change.*

Keywords*: Net-zero economy, waste management, circular economy, sustainable packaging, resource efficiency, extended producer responsibility (EPR), carbon emissions reduction, biodegradable materials, recycling, public-private partnerships, policy frameworks, environmental innovation.*

Non-Invasive Material Identification and Separation of Solid Waste for Recycling Plant

Kandaswamy K V[1,*], B. Bakayalakshmi[2]
[1]Rajalakshmi Engineering College, Thandalam, Chennai, India
[2]SRM University, Computer Science Engineering, Kattagulathur, Chennai, India
**Corresponding Author: kvksamys@gmail.com*

ABSTRACT: *Abstract: An important difficulty facing municipal authorities is the growing need for Solid Waste Management (SWM). Many integrated systems and techniques have been developed to address this issue. Solid waste is stuff that is discarded, undesired, and worthless that comes from regular communal activity. The field that deals with managing the creation, handling, collection, transportation, processing, and disposal of solid waste is known as solid waste management. This paper proposed, the separation of solid waste such as plastics, woods, clothes, papers, metals and other organic wastes. Moreover, separation of solid waste is necessary for recycling and reuse. The Triad Spectroscopy Sensor AS7265x can measure and characterize how various types of materials absorb or reflect 18 different frequencies of light ranging from 410nm to 940nm. The sensor is made by the combination of visible, UV & IR LEDs or 3 different sensors like AS72651 (UV), AS72652 (VIS), and AS72653 (NIR) called Triad Spectroscopy. Once the waste is identified, a separate bin is place to collect each material using separate conveyor action. The sensor senses which type of solid and separate the wastes using different bin. The level sensor is placed in each bin which measures the 80% of occupancy filled. This process of sending notification is implemented using IFTTT (If This Then That)..*

Keywords*: Ultraviolet, Infrared, Triad Spectroscopy. Recycle, Separation.*

Sustainable Waste Management: Approaches towards Sustainability in India

J. Balaji*, R. Prabusankar

GRG School of Management Studies, PSGR Krishnammal College for Women (Autonomous), (Affiliated to Bharathiar University), Peelamedu, Coimbatore, Tamil Nadu, India

**Corresponding Author: laxminarayana@jbnagwater.com / jbnagwater@gmail.com*

ABSTRACT: *Environmental sustainability is essential for preserving resources like clean air, water, and wildlife for future generations. Effective waste management plays a vital role in this, as improper disposal can result in significant pollution of air, water, and soil. In addition to lowering greenhouse gas emissions, waste management also enhances the state of anyplace impacted by the waste and the quality of the air and water. The advantages of sustainable waste management for the environment are numerous. Greenhouse gas emissions are greatly reduced when less waste is dumped in landfills, which helps to mitigate climate change. Recycling is another way to conserve natural resources, which supports ecosystem maintenance and biodiversity preservation. To lessen the quantity of garbage that ends up in landfills and lessen the impact on the environment, waste management aims to extend the lifecycle of products and, when feasible, reuse and recover resources. Not only will less garbage preserve the environment, but it will also save money or lower disposal costs. Similarly, recycling and/or reusing garbage reduces the need to extract resources and lessens the risk of contamination, both of which are beneficial to the environment. Anything that lowers waste by initially utilizing less material is considered waste reduction. Using a sheet of paper on both sides, switching to ceramic mugs from disposable cups, and making bulk purchases rather than singleunit purchases can all help reduce waste. In the modern world, when environmental concerns are more important than ever, sustainable waste management is essential. Adopting efficient waste management techniques contributes to a cleaner and healthier environment for coming generations as well as a reduction in the ecological imprint. It is determined that implementing a strategy for trash reduction that involves all community stakeholders is a wise choice when it comes to sustainable waste management. The study region was New Delhi, the capital of India, and it featured a questionnaire survey of 320 individuals using simple random sampling. This article explores the many facets, advantages, and difficulties of environmentally friendly waste management lowering waste in a community while involving all relevant parties.*

Keywords*: Sustainability, Sustainable Development, Waste Management.*

A Comprehensive Review of Solid Waste Management in India: Challenges, Policies, and Duture Directions

Gowri Lakshmi*, G.V.K. Kasturi

GITAM school of Business, Gitam deemed to be University, India

**Corresponding Author: gvanapal@gitam.edu*

ABSTRACT: *This research paper offers a comprehensive of solid waster management from an Indian perspective, providing an in-depth analysis of the current status, challenges, and opportunities in the field. It focusses on the environmental sustainability and public health aspects of waste management. The study delved into the types and composition of sold waste generated in India, reviews exiting waste management practice, and examines the legal and practices, and examines the leal and policy framework that governs water handling in the country. Additionally it covers the press involved in the collection, transportation, disposal, and treatment of solid waste.*
The review identifies key challenges such as infrastructure and resource limitations, institutional and governance issues, and the environmental and social impacts of current waste management practices. It also highlights opportunities for improvement trough sustainable waste management approaches, including integrated waste management systems, advancements in technology, and active community participation. The findings of this review offer valuable insights for policymakers and practitioners, helping to shape effective and sustainable strategies for managing sold waster in India.

Keywords*: Environment sustainability, public health, sustainable waste management.*

Urban Sprawl Leading to Challenges for Waste Management in Cities – A Case of Nandi Hills, Bengaluru

Sneha Manjunath*

Interior Design Department, Nitte School of Fashion Technology and Interior Design, Bengaluru, Karnataka, India

**Corresponding Author: arsnehamanjunath@gmail.com*

ABSTRACT: *Urban sprawl is a major underlying cause for unplanned development in metropolitan cities. Unplanned development raises concerns in terms of spatial development, infrastructure planning and service distribution. One of the major concerns in growing urban areas is waste segregation and management. The present study comprehends the physiological and psychological effects and ineffective implementation of laws by governing body and their effects on biodiversity in and around Nandi Hills. A pilot study was conducted to understand the human approach to types of waste generated, waste collection and segregation procedures, awareness about the concept of reuse-recycle-reduce, dealing with various social taboos and awareness about the impact on flora and fauna around the precinct. The study implies that there is a need to educate and effectively implement policies at various decentralized levels to ensure the effect from untreated waste and poor waste management has least impact on the biodiversity existing around the precinct. This study shows the potential of human intervention to reduce the negative impacts by formal or informal modes of administration to ensure the flourishment of nature is secured for the future generations.*

Keywords*:*

Harnessing Waste for Sustainable Construction: A Review on the Mechanical and Microstructural Properties of the Geopolymer Concrete with Waste-Derived

S. Sona*, S.P. Sangeetha

Aarupadai Veedu Institute of Technology, Vinayaka Missions Research Foundation, Salem, India

**Corresponding Author: sonasaravananssva@gmail.com*

ABSTRACT: *The construction sector's heavy reliance on Ordinary Portland Cement (OPC) poses significant environmental challenges, contributing up to 8% of global CO2 emissions. In response, geopolymer concrete, made from industrial by-products rich in aluminosilicates, presents a sustainable alternative. However, commercial alkaline activators like NaOH and Na2SiO3, used in geopolymer concrete, remain expensive and exhibit adverse ecological impacts. Recent research focuses on developing waste-derived alkaline activators as alternative solutions, aiming to mitigate these challenges. This review critically evaluates the mechanical and microstructural properties of geopolymer concrete produced using waste-derived alkaline activators from agro-industrial and commercial sectors. Waste-derived activators provide significant environmental benefits, such as reduced carbon emissions and lower production costs, by repurposing industrial by-products that would otherwise contribute to landfill waste. This review also explores techniques for extracting sodium silicate from silica-rich waste, focusing on their potential to replace traditional activators. The findings highlight the dual advantages of geopolymer concrete: enhanced mechanical properties and significant sustainability gains. Findings reveal that these waste-derived activators, combined with slag-based binders, can enhance compressive strength by up to 20% compared to commercially activated concrete. Microstructural characterization of geopolymers with waste-derived activators demonstrates characteristics comparable to those activated using commercial alkaline sources. Future research directions are identified to optimize the formulation of these alternative activators, advancing the scalability of geopolymer concrete as a mainstream construction material. This aligns with global efforts to transition towards a circular economy and mitigate the environmental impacts of concrete production.*

Keywords*:*

Use of Recycled Materials in Geotechnical Engineering Practice

V. Vinot, S.V. Sivapriya*
Dept. of Civil Engineering, Sri Sivasubramaniaya Nadar College of Engineering, Kalavakkam, India
**Corresponding Author: sivapriyasv@ssn.edu.in*

ABSTRACT: *Recycled material, which frequently has little lasting value, is an inevitable byproduct of most industrial and human operations. Due to population increase and economic progress, a substantial quantity of waste is produced from a variety of sources, including home and industrial activity. At global scale, waste materials generation are constantly rising and this increasing in trend urge everyone to find out the innovative ways to recycle or reuse them. Reuse and recycling are important strategies in minimizing landfill deposition and the negative effects of waste to solve these issues. Recycling lowers energy use in addition to aiding in the preservation of natural resources. Reusing waste materials as alternatives in geotechnical and geoenvironmental applications has gained popularity recently. A comprehensive understanding of waste's categorization, many technical characteristics, and environmental implications as well as how these relate to one another is crucial for its effective usage. This purpose of this study is to review the possibilities for utilizing various recycled materials as geomaterials, including coarse-grained recycled materials like bottom ash, waste tires and recycled aggregates. It aims to support the sustainable geotechnical engineering techniques by achieving this. Overall, these recycled materials form a major field of study aimed to promoting sustainability in geotechnical engineering practice.*

Keywords*: Sustainability, recycled materials, bottom ash, waste tires, recycled aggregates.*

Leveraging Internet of Things (loT) and Deep Learning for Sustainable Biomedical Waste Management: An Advanced Framework for Real-time Monitoring and Waste Classification

Mohith Ram Devineni*
India
**Corresponding Author: 121916101077@gitam.in*

ABSTRACT: *This study introduces an loT and deep learning-based framework designed to enhance biomedical waste management through real-time monitoring and efficient waste classification. By utilizing loT sensors in conjunction with advanced machine learning models and autoencoders, the system automates waste tracking, timely collection, and the categorization of hazardous materials. loT sensors enable continuous data collection on waste generation, supporting pattern analysis to optimize waste management processes. This approach addresses critical challenges in mismanagement, including the prevention of overspills, control of Odors, and the handling of hazardous waste types. By leveraging real- time data, healthcare facilities can improve the segregation and ·disposal of biomedical waste, minimizing risks to both human health and the environment. The integration of these technologies contributes to a cleaner, more sustainable waste management ecosystem, ensuring regulatory compliance and enhancing operational efficiency. Ultimately, the proposed system demonstrates how loT and Al-driven solutions can revolutionize waste management in healthcare settings, mitigating environmental impacts and improving overall public health outcomes.*

Keywords*: Biomedical Waste, Deep Learning, loT (Internet of Things), Machine Learning, Real-time Monitoring.*

Stakeholder Analysis and Influential Factors in Waste Management Systems: A Global Study

Nikhil Ranjan Behera[1], Rachan Karmakar[1,*], Joselyn BC Toomey[1], Adhirath Mandal[2]

[1]Department of Environmental Science, Graphic Era (Deemed to be University), Dehradun, India

[2]Department of Mechanical Engineering, Graphic Era (Deemed to be University), Dehradun, India

**Corresponding Author: rachan.in.air@gmail.com*

ABSTRACT: *Waste management for Biodegradable and Non– biodegradable is a multi-faced challenge for the Tier I and Tier II municipal authorities in developing countries like India mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated with its management, the lack of understanding of a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system to function. An analysis of literature on the work done and reported mainly in publications from 2012 to 2020, related to waste management in developing countries, showed that few articles give quantitative information. The analysis, conducted by several leading scientific journals, examined management practices to convert waste to energy in a sustainable manner, demonstrating minimal budgetary approaches and consumer awareness. This research aimed to determine the public action/behavior that has a role in the waste management process and to analyze influential factors on the system, in more than thirty urban areas in 5 major developed countries across 4 continents. A combination of methods was used in this study to assess the stakeholders, and the factors influencing the performance of waste management in the cities. Data was collected from literature, databases, urban area visits, interviews with professionals, workshop exercises, and stakeholder questionnaires. Descriptive and inferential statistical methods were used to conclude. The research produced a list of relevant stakeholders in waste management systems and identified key factors causing system failures. The information provided is very useful When planning, changing, or implementing a municipal waste management system.*

Keywords*: Waste management, biodegradable and non-biodegradable waste, stakeholders, influential factors, sustainable waste-to-energy.*

An Enhanced Model for Waste Management System using AI and IoT based Techniques

A B Manju, J Jegan, D Jagadeesan, G B Himabindu, Y Sreeraman, T Vivekanandan

The Apollo University, Chittoor, Andhra Pradesh, India

**Corresponding Author: abmanju21@gmail.com*

ABSTRACT: *Efficient waste management remains a significant challenge as urban populations grow, leading to increased environmental and operational costs. Traditional waste collection systems follow static schedules, often resulting in overflowing bins or unnecessary collections, thereby raising costs and emissions. This paper proposes an AI-driven smart waste management system, integrating IoT-enabled waste segregation bins and AI-based collection optimization algorithms. IoT sensors in bins provide real-time data on waste fill levels, allowing AI algorithms to optimize collection schedules by considering factors like waste generation rates, traffic conditions, and proximity to decomposition centres. Simulation results demonstrate significant improvements over traditional systems. Fuel consumption is reduced by 32.47% ,while operational costs decrease by 26.83%. Additionally, waste overflow events are minimized from 8.54% to 1.89%, and waste segregation accuracy improves by reducing contamination from 12.33% to 3.96%. Emissions are also lowered by 28.14%, cutting CO2 output from 55 kg to 39.5 kg per route. These results highlight the long-term sustainability benefits of transitioning from traditional waste collection systems to AI-enhanced, real-time optimized solutions, aligned with circular economy principles. The proposed system not only enhances operational efficiency but also significantly contributes to reducing the environmental footprint of urban waste management.*

Keywords*: AI-driven waste management, IoT-enabled bins, waste collection optimization, real-time data, circular economy.*

Leveraging Machine Learning for Optimized Urban Waste Prediction in GITAM University Bengaluru

Arvind Kumar[1], Mahesh Chandra[2,*], Jaya Prakash Sahoo[1]

[1]Dept. of EECE, Gitam University, India

[2]School of ECE, Reva University, India

**Corresponding Author: arvind9835@gmail.com*

ABSTRACT: *Effective waste management is crucial for maintaining sustainable practices in educational institutions. This paper focuses on implementing a machine learning-based predictive waste management system at the GITAM University Bengaluru campus. By analyzing historical data on waste generation across different departments, hostels, and canteens, the model predicts waste volumes and optimizes collection schedules to reduce inefficiencies. Socioeconomic factors, seasonal variations, and student activities are integrated into the model to enhance prediction accuracy. Additionally, route optimization algorithms are employed to minimize travel distances for waste collection, leading to a reduction in fuel consumption and carbon emissions. The study demonstrates how data-driven approaches can improve operational efficiency, resource allocation, and environmental impact on a university campus. The project aligns with GITAM's vision of sustainability and serves as a case study for similar educational institutions aiming to optimize their waste management practices.*

Keywords*: Predictive Waste Management, Machine Learning, Sustainable Practices, Route Optimization, Campus Waste Management.*

Wastescapes and Circular Economy: A Review on the Mapping Methods and Strategies for Urban Regeneration

Surekha K C*, Pradeep G Kini, Arun Natarajan Hariharan

Manipal School of Architecture and Planning, Manipal Academy of Higher Education, Manipal, India

**Corresponding Author: surekha.kc@manipal.edu*

ABSTRACT: *The rapid urban population in the towns and cities has heightened concerns over land and its use, making land an increasingly scarce and precious resource. However, there exists a paradox. While some land remains vacant or abandoned within city centers, urban sprawl leads to fragmentation in the peripheral areas. This results in 'wastescapes', neglected areas due to fragmentation, buffering, obsolescence or blight. They are often formed due to rapid urbanization, socio-cultural factors or environmental degradation. Despite their current state, these wastescapes possess untapped potential for transformation, as productive spaces aligning with compact and sustainable development. This paper explores the potential of wastescapes through the lens of circular economy which seeks to eliminate waste and maintain assets at their highest value. By adopting a narrative review approach, the study examines various mapping methods and circular strategies that can be used to repurpose these neglected areas. The research provides valuable insights into urban regeneration and offers a comprehensive overview of circular strategies fostering compact, sustainable, resilient landscapes and cities.*

Keywords*: Circularity, Wastelands, Spatial planning, Sustainable land development, Compact cities.*

Comparative Analysis of Environmental Risks from Landfill Waste in Four Most Urbanized Cities of Bangladesh

Md. Tushar Ali[1,*], Islam M. Rafizul[2]

[1]SCIP Plastics Project, Department of Civil Engineering, KUET, Khulna, Bangladesh

[2]Department of Civil Engineering, KUET, Khulna, Bangladesh

**Corresponding Author: imrafizul@ce.kuet.ac.bd*

ABSTRACT: *Bangladesh, a developing country with rapid population growth, rising per capita municipal solid waste and nearly 95% of its landfills are unsanitary or open dumps faces serious environmental pollution. This study assesses the risks of water and air pollution from plastics, leachate, and pollutant gases in four major cities: Dhaka, Chittagong, Khulna, and Rajshahi. Key factors for water pollution risk include proximity to water bodies (streams, rivers, and the sea) and rainfall data, while air pollution risk considers wind speed, temperature, and the distance of the city center from landfills. A comparative risk assessment is performed using Data Envelopment Analysis (DEA) using MATLAB, categorizing pollution risks into six levels, from very low to severe, with values ranging from 0 to 1. Results reveal that Sylhet and Chittagong are in very high-risk zones for water pollution, with Sylhet's high risk linked to heavy rainfall and Chittagong's to the landfill's proximity to the sea. Dhaka and Rajshahi are categorized as high and low risk, respectively, based on their landfill locations and low rainfall. In terms of air pollution, Dhaka is at severe risk due to its landfill being in the city center and higher temperature. Khulna is classified as high risk due to its high wind speeds and relatively warm temperatures. Rajshahi and Chittagong fall into the moderate risk category, influenced by their landfill locations and lower wind speeds. This study provides critical insights for policymakers and city planners, emphasizing the need to relocate landfills and implement advanced leachate management strategies to mitigate pollution risks.*

Keywords*: Environmental Risk; Water Pollution; Air Pollution; DEA; Urbanized Cities; Bangladesh.*

A Study on Vermicomposting Process of Areca Husk and Leaf Sheath Wastes for Sustainable Utilization and Management Approach in Tarikere Taluk, Chickmagalore District, Karnataka, India

Rakesh Naik A C[1], Narayana J[2,*]

Department of P.G. Studies & Research in Environmental Science, Kuvempu University, Shivamogga, Karnataka, India

**Corresponding Author: janaes@rediffmail.com*

ABSTRACT: *In recent days, there is a great demand for agricultural wastes using for agriculture, Areca leaf sheath wastes are utilized for making plates, cups, hats and ornamental materials as well as other agricultural products. Besides, that it is used as mulching material and bio composting purposes. On the other hand theses waste are dumped in open areas which directly reach to water bodies and causes degradation of water pollution and also due to burning of waste materials leads to atmospheric pollution. Therefore, the present study was carried out to recycle the waste and convert in to nutrient-rich organic fertilizer. Standard methodology employed for vermicomposting process in the laboratory scale. Four Treatment studies was carried out in a plastic rectangular container of 0.235 m width, 0.322 m length and 0.28 m height were used for conducting experiments. The arecanut husk and leaf sheath waste wastes arranged layer by layer and inoculated with the cowdung slury jeevamrutha compost culture and earthworms. in each treatment was observed the variation of composting process and recorded the changes in every 15 days. The final compost was harvested and analysed the nutrient characteristics by following the standard method. The initial C: N ratio of untreated areca husk and leaf sheath wastes was 110-120, Areca husk and leaf sheath inoculated with different microorganisms was found to decrease significantly and it ranged from 15.86 to 27.33 in different treatments, The findings reveals that areca husk and leaf sheath waste can be successfully converted into a high-quality compost and rich in essential nutrients and microorganisms for sustainable agriculture practices. This innovative approach offers a promising solution for waste management.*

Keywords*: Areca leaf waste, vermicompost, Earthworms.*

Cost – Effective Production of Organic compost from forest-based waste (Shorea robusta) by Amrit Krishi Farming model

Tapasi Polley*, Sidharth Biswas, Priya Kumari, Priti Kumari, Soumyajit Das
Amrit Krishi, Shalboni, Baharagora, East Singbhum, Jharkhand, India
**Corresponding Author: tapasipolley@gmail.com*

ABSTRACT: *According to present and past moment, Cosmos is merchandising with two problems i.e. Pollution and its Fallout on soil but the only solution is organic compost (Amrit Soil), containing advantageous microorganisms (Azotobacter & Rhizobium – nitrogen fixer in soil) offering a natural & economical clarification or rejoinder for soil fertility and rectifying crop productivity. The in – depth is, it involves collection and neutralization of forest waste & due to fermentation malfunction of organic matter, it results in the release of essential nutrients. As Maturation and Stabilization processes ensure the viability and effectiveness of the microorganisms. Simultaneously, analyzation by verification Quality is executed to appraise nutrient content, microbial population, pH, moisture & water content and absence of harmful substances. This probing contributes to imperishable & supportive agriculture by appertaining forest waste (Shorea robusta) as a valuable Amrit soil production, promoting soil health and reducing reliability on chemical fertilizers. The Production of Amrit Soil from forest waste - Shorea robusta offers a sustainable rejoinder to nutrient management in organic farming while simultaneously addressing waste management challenges. By harnessing the potential of advantageous microorganisms (Azotobacter and Rhizobium), it contributes to on – line analyzation & investigation, soil health improvement, chemical free finished goods & organic farming.*

Keywords*: forest waste, Shorea robusta, Azotobacter & Rhizobium, Cost -effective production, Quality part.*

Solid Waste Management of Varanasi: A Step towards Zero Waste Sustainability

Manvi Jain*
India
**Corresponding Author: manvijain@bhu.ac.in*

ABSTRACT: *Varanasi, like many Indian cities, faces significant challenges in managing its municipal solid waste. With over 1300 tonnes per day of MSW generated, the city's waste infrastructure is under strain. The primary processing facility at Karsada, with a capacity of 600 TPD, operates well below the demand, leaving a substantial portion of waste unprocessed. This study examines the existing waste management practices in Varanasi through a combination of primary surveys and secondary data from the Varanasi Smart City, Municipal Corporation and Central Pollution Control Board records. A survey was conducted to assess the perception of inhabitants near the Karsada and commercially non-functional Ramana plants, as well as citywide perceptions on waste management. Varanasi, with a processing capacity gap of nearly 50%, highlights the need for immediate intervention. Based on the findings, an integrated and sustainable waste management model is proposed, emphasizing the importance of increasing processing capacity, improving waste segregation, and enhancing public engagement. The proposed design aims to minimize landfill use, increase recycling, and move Varanasi closer to its goal of becoming a zero-waste city, aligning with national environmental sustainability targets.*

Keywords*: Integrated solid waste management; zero waste; citizen perception; sustainability.*

Observation of temperature development during food waste composting process

Huu-Tuan Tran[1,2], Chitsan Lin[3], Ngoc Son Hai Nguyen[4], Khoi-Nghia Nguyen[5], Hong-Giang Hoang[6,*]

[1]Laboratory of Ecology and Environmental Management, Science and Technology Advanced Institute, Van Lang University, Ho Chi Minh City, Viet Nam
[2]School of Technology, Van Lang University, Ho Chi Minh City, Viet Nam
[3]Dept. of Marine Env. Engineering, National Kaohsiung University of Science and Technology, Taiwan
[4]Thai Nguyen University of Agriculture and Forestry (TUAF), Thai Nguyen, Viet Nam
[5]Department of Soil Science, College of Agriculture, Can Tho University, Viet Nam
[6]Dong Nai Technology University, Bien Hoa City, Viet Nam

**Corresponding Author: hoanghonggiang@dntu.edu.vn*

ABSTRACT: *Food waste is released mainly from daily cooking activity. It will be useful if it can be utilized for composting. During the aerobic composting process, the temperature is one of the key parameters that can affect the maturity process as well as compost quality. Therefore, in this study, the development of temperature has been carefully observed in the simple food waste composting piles with 400 kg scale under turnover and without turnover conditions. The compost mixture was mixed from food waste, sawdust and mature compost at a ratio of 13:3:4 (w/w). The results showed that the moisture content range of 55-70% was favoured for the composting process. In addition, the feeding of mature compost was not only to increase the temperature but also to adjust moisture content. The maturity of compost with turnover is better than without turnover. During the turnover incubation, the highest temperature of 75℃ was observed on day 16 and remained in the range of 70-75℃ for 10 days. This long thermophilic phase (50% of the composting period) seemed to be beneficial for the microbial decomposition, resulting in shortening the maturity period of compost for this study (28 days) compared with other studies (37 days or more). The results provide deeper insights into the importance of the temperature in the food waste composting process. Besides, with the saving initial investment costs and the simple operation, it also shows the potential of composting with household scale application.*

Keywords*: Food waste; initial moisture; temperature variation; mature compost ratio.*

Sustainable Concrete: Evaluating the Strength of M25 and M30 Grades with Partial Cement Replacement using SCBA, GGBS, and Granite Powder

Borigarla Barhmaiah, Padmakar Maddala*, Karri Srinivas

Vignan's Institute of Information Technology (A), Visakhapatnam, India

**Corresponding Author: padmakarmaddala@gmail.com*

ABSTRACT: *This research investigates the potential of partially replacing cement with Sugarcane Bagasse Ash (SCBA), Ground Granulated Blast Furnace Slag (GGBS), and Granite Powder (GP) in M25 and M30 grade concrete, aiming to reduce reliance on Ordinary Portland Cement (OPC) and lower carbon emissions associated with concrete production. Each of these materials is a by-product from industries with environmental concerns: SCBA from sugar mills, GGBS from steel production, and GP from granite processing. By optimizing their usage in concrete, this study contributes to sustainable waste management and eco-friendly concrete. Concrete samples were prepared with varying replacement ratios of SCBA, GGBS, and GP. The results demonstrate significant improvements in mechanical properties at optimal replacement levels of 10% SCBA, 50% GGBS, and 10% GP. For M25 and M30 grades, this combination enhanced compressive strength, with peak 28-day values reaching 31.15 N/mm² and 35.76 N/mm², respectively, under water curing. Tensile strength also improved, reaching maximum values of 4.31 N/mm² and 5.45 N/mm² for M25 and M30 grades, outperforming conventional mixes. Statistical regression models developed for compressive and tensile strength yield high accuracy, with R^2 values of 0.92 and 0.89, confirming the consistency of results. The findings establish that replacing OPC with SCBA, GGBS, and GP not only improves concrete strength and durability but also provides a sustainable approach to waste management. Utilizing these industrial by-products in construction promotes resource conservation, reducing environmental impacts and advancing sustainable development practices in the construction sector. Future research should focus on the long-term durability of these mixes in diverse environmental conditions to further solidify their applicability in mainstream construction.*

Keywords*: Sustainable Concrete, Compressive tensile strength, Partial Replacement, Regression Analysis.*

Social Entrepreneurship, Waste Management, and the Circular Economy: Innovative Approaches in Malaysia

Shafinar Ismail*
Universiti Teknologi MARA Melaka
**Corresponding Author: shafinar@uitm.edu.my*

ABSTRACT: *Social entrepreneurship, waste management, and the circular economy are interconnected concepts that seek to generate long-term solutions to societal and environmental concerns. Social entrepreneurship entails developing new solutions to social, cultural, or environmental issues. Entrepreneurs in this field prioritize both social impact and financial sustainability. Integrating social entrepreneurship with waste management and circular economy principles can result in innovative solutions addressing environmental challenges while promoting social fairness and economic resilience. Advocacy, community participation, and policy support are critical to achieving these interconnected goals. Social enterprises can offer work possibilities in waste management by teaching and supporting neglected groups. For example, in Malaysia, the link between social entrepreneurship, waste management, and the circular economy is emerging through innovative approaches that harness local resources and empower communities. Examples and solutions include community-based waste management initiatives, up cycling and creative businesses, education and awareness campaigns, urban gardening and composting initiatives, collaborative recycling programs, and innovative product take-back programs.*

Circular Economy and Waste Management: A Pathway to Sustainable Living through Household Waste Management

Swati Kadambala[1*], Sireesha Rani Vasa[1], Ravi Kumar Karnayina[2]
[1]GITAM School of Business, Department of Organisational Development & Human Resource (OD&HR) GITAM (Deemed to be) University, India.
[2]Department of Management Studies, Sri Sivani College of Engineering, India
**Corresponding Author: Skadamba4@gitam.in*

ABSTRACT: *The global shift toward environmental sustainability underscores the critical need for effective waste management. The purpose of this study is to examine the role of circular economy principles in enhancing household waste management practices, ultimately contributing to sustainable living. In a world where household waste forms a substantial part of municipal solid waste, there is a pressing need to transition from a linear to a circular economic model. This research addresses the central question: How can circular economy strategies in household waste management promote sustainability? Design/methodology/approach: A mixed-methods approach is utilized, incorporating qualitative and quantitative analyses. The qualitative component includes a comprehensive literature review and case studies of effective circular economy implementations across regions, while the quantitative analysis examines data on household waste generation, recycling rates, and resource recovery efforts. Surveys and interviews with households and waste management professionals further inform the current state and potential for improvement in household waste management practices. Findings: The findings reveal that circular economy principles, when applied to household waste management, significantly reduce environmental impacts. Enhanced recycling programs, composting initiatives, and durable product usage contribute to a potential 40% reduction in waste sent to landfills. However, barriers such as low public awareness, inadequate infrastructure, and regulatory limitations continue to hinder full adoption of these practices. Implications: This study highlights the importance of a holistic approach to waste management, involving public awareness campaigns, government incentives, and supportive infrastructure. Policymakers are encouraged to adopt regulatory frameworks that promote long-lasting, recyclable products and foster circular economy practices at the household level. Originality /value: This study contributes to the growing field of circular economy research by focusing on household waste management as a critical area for sustainable development. It provides actionable strategies and insights for stakeholders aiming to reduce environmental degradation through more sustainable waste management practices.*

Keywords*: Household waste management, circular economy, sustainable living, recycling, waste reduction.*

Effect of Inefficient Waste Management Methods on Pollution- Cause and Effect Analysis

Jyothilakshmi R*, Bhuvanesh V. R
Dept. of Mechanical Engineering, Ramaiah Institute of Technology, Bengaluru, Karnataka, India
**Corresponding Author: jyothilakshmi.r@msrit.edu*

ABSTRACT: *The global accumulation of solid waste, driven by rising populations and increased consumption, presents significant challenges to public health and environmental sustainability, particularly in developing countries. This study examines the health impacts of poor waste management practices through a systematic review of literature and a focused analysis on Rawalpindi, Pakistan. Findings indicate that ineffective waste management, characterized by hazardous mixing of waste, uncontrolled dumping, and open burning, leads to serious public health issues, including the spread of infections and respiratory diseases, as well as environmental degradation through air and water pollution. Vulnerable populations are disproportionately affected, exacerbating social inequalities. Current study deals with the negative aspects of unscientific waste management system which are influenced by social, economic, geographical and educational factors. The study highlights the need for improved waste management strategies, including strengthened legislative measures, enhanced community engagement, and better resource allocation, to foster sustainable urban environments and mitigate health risks associated with solid waste.*

Keywords*: Solid waste, Public health, Pollution, Urbanization, Environmental sustainability, Waste management, Community engagement, Legislative measures, Social inequality.*

Awareness and Practices toward Sustainable Waste Segregation & Climate Change Impact

Chetana Harika Oruganti, Suneetha Kandi*, Sri Manasa Devi Naguru
GITAM University, India
**Corresponding Author: skandi@gitam.edu*

ABSTRACT: *Purpose: This study examines public awareness, attitudes, and practices related to waste segregation and climate change among residents of Visakhapatnam, India. Method: Data was gathered using a cross-sectional online survey distributed to 148 participants aged 18 to 65, with an average age of 33.6 years. The sample comprised 67 females and 81 males, including 113 urban and 35 semiurban residents. The survey assessed demographics, awareness and practices related to waste segregation, and climate change knowledge. Key barriers to waste segregation and sources of climate change information were also investigated. Findings: Results reveal that 93.9% of participants recognised the importance of waste segregation, and 89.9% were knowledgeable about proper segregation methods. However, only 41.2% consistently segregated waste at home, with an additional 48.6% doing so occasionally. The primary barriers identified were lack of time (27%), inadequate facilities like separate bins (25.7%), and limited awareness (20.3%). In terms of climate change awareness, 94.6% of respondents were knowledgeable, attributing primary causes to carbon emissions from vehicles and industries (80.4%), deforestation (77.7%), and ozone layer depletion (64.2%). While 75% viewed developed nations as major contributors to global warming, 80.1% felt that developing countries are more vulnerable to its impacts. The primary sources of climate information were the internet and social media (81.8%). Implications: The study's findings highlight the need for targeted interventions, such as enhanced access to waste segregation facilities and educational programs that address knowledge and logistical barriers. By improving waste management infrastructure and fostering greater community awareness, these initiatives could support sustainable practices and improve climate resilience in Visakhapatnam's urban and semiurban areas. Originality & Value: This study offers valuable insights into the environmental attitudes and behaviours of Visakhapatnam residents. These findings contribute essential data for policymakers and environmental organisations in developing strategies of sustainable waste management and climate resilience.*

Keywords*: Waste Segregation, Climate Change Awareness, Environmental Practices, Sustainable Waste Management, Visakhapatnam.*

Performance and Durability of Concrete with Recycled Waste Additives: A Step towards Green Construction

Anjali Singh, Pratish Kannaujiya*
Department of Civil Engineering, Buddha Institute of Technology, Gorakhpur Uttar Pradesh, India
**Corresponding Author: kannaujiyapratish@gmail.com*

ABSTRACT: *Concrete stands as the cornerstone of modern construction, ranking as one of the most utilized materials globally, second only to water. Yet, its extensive production presents challenges such as the depletion of natural resources due to aggregate extraction and the emission of greenhouse gases exacerbating climate change. In response to these concerns, this study delves into innovative methods to enhance the eco-friendliness of concrete. By harnessing materials like Marble dust powder, iron slag, and coconut shells, traditionally considered waste, we aim to not only address disposal issues but also mitigate environmental impacts. Our research focuses on evaluating the mechanical, durability, and sustainability implications of incorporating these alternative materials into concrete mixtures. Through varying proportions of marble powder, iron slag, and coconut shells as substitutes for cement, fine aggregate and coarse aggregate, ranging from 0% to 40%, we seek to optimize the balance between performance and environmental stewardship. Maintaining a constant water/cement ratio of 0.45 across all mixes, we assess the compressive strength of the concrete at 7, 14, and 28 days. Notably, this eco-friendly concrete demonstrates a reduced weight compared to conventional counterparts, rendering it particularly suitable for applications where weight reduction is a priority.*

Keywords*: Marble dust powder, Coconut shell, Iron waste.*

Driving sustainable waste management and research innovations in Nigeria: challenges and opportunities

Olumuyiwa A. LASODE*
Department of Mechanical Engineering, University of Ilorin, Ilorin, Nigeria
Department of Mechanical and Metallurgical Engineering, School of Engineering and the Built Environment, University of Namibia, Namibia
**Corresponding Author: oalasode@unilorin.edu.ng*

ABSTRACT: *As Nigeria's population surpasses 200 million and urbanization accelerates, effective waste management becomes critical to safeguarding public health, the environment, and sustainable economic growth. However, the country faces significant challenges, including limited waste collection infrastructure, financial constraints, low public awareness, and regulatory enforcement gaps. This lecture will explore the current state of waste management in Nigeria, examining the unique hurdles that hinder sustainable practices and contribute to environmental degradation, particularly in rapidly growing urban areas. Innovative research is helping address these challenges through sustainable solutions tailored to Nigeria's needs. Examples include biochar production from agricultural waste, which transforms cassava peels and rice husks into carbon-rich materials suitable for soil enhancement, pollutant adsorption, and energy storage applications. Efforts to repurpose plastic waste into building materials and establish circular economy models for food waste are also gaining momentum, offering both environmental benefits and economic opportunities. By leveraging these advancements, Nigerian researchers and policymakers are progressively closing the gap between waste generation and sustainable disposal. The lecture will conclude with a discussion on the role of international collaboration in advancing Nigeria's waste management systems. Opportunities for knowledge exchange, capacity building, and investment from global partners could provide the necessary support for scaling these solutions and addressing Nigeria's waste crisis. This dialogue aims to foster a joint vision for transforming waste into wealth and developing a robust, sustainable future in Nigeria.*

Keywords*:*

Implementing Behaviour Change Strategies for Solid Waste Management in a Circular Economy

Nawa Raj Khatiwada[1,*], Susmina Gajurel[2]

[1]Nepal Development Research Institute (NDRI), Lalitpur, Nepal
[2]University of Western Sydney, Sydney, Australia

**Corresponding Author: nawa@ndri.org.np*

ABSTRACT: *In a circular economy, the design, use, and disposal phases are key stages where most users or customers interact with the product or its waste. Key interfaces such as like user-product serve as leverage points where small changes can create large impacts, making every decision of a user or customer vital to the circular economy's success. In contrast, the linear economy operates under the assumption that all users will make rational choices and can be effectively managed through a command-and-control approach. Coercive measures focus on enforcing compliance rather than addressing motivations behind behaviours. This study emphasizes the potential of social and behaviour change interventions, applied at critical leverage points across various stages of the circular economy. Few examples illustrating the outcomes of coercive policy instruments are provided. People do not hesitate to litter in an area right below a signboard that mentions imposing a heavy penalty and/or jail sentence for throwing waste in the area. Guests attending ceremonies consume only half of the food they take, leaving the other half to go to waste. In contrast, non-coercive interventions like Nudge Instruments provide solutions that address behaviour-related issues at leverage points within key interfaces. A successful example of the later is the use of religious images in place of punitive signage. Another example is the production and use of incense sticks made from flowers offered at temples after worship. The paper concludes that well-designed, cost-effective strategies can effectively foster long-term positive behavior changes in waste management within a circular economy.*

Keywords*: Behavior Change, Circular Economy, Nudge Instruments, User-waste Interface, Solid Waste.*

Assessment of Environmental and Health Impacts of Dumpsite in the Proximity to Human Settlements

Maeti George*

The National University of Lesotho

**Corresponding Author: maetigeorge@gmail.com*

ABSTRACT: *Mismanagement of solid waste encourages indiscriminate disposal near residential areas, and illegal dump sites pose threat to public health and the environment at large. Aim: This study was aimed at assessing environmental pollution within regions near the Tsosane dumpsite and implications onto human health. Data collection: Interview sessions were held for 98 community members. Those who were within 250m radius (49) were categorized as 'nearby' and the rest (beyond 250m) as 'far away' from the dumpsite. Data analysis: descriptive statistics including percentage and frequencies of occurrence were utilised to analyse data. Charts and tables were used to present the results. T-test was used to determine if there were significant differences between the two groups. Results: bad odours were reported by all (100%) residents within the 250m radius, and reported by 27% of those beyond 250m from the dumpsite. Approximately 96% of nearby residents reported rat infestation and 94% reported fly infestation, and these were reported by 16 and 10% of residents far from the site respectively. Eye irritation was reported by 78% of nearby residents and 10% of faraway residents. Furthermore, nearby residents were at the highest risk of respiratory diseases like asthma and TB, and sore throat. Conclusions: The study concludes that the dumpsite is a health hazard to residents, and those in its proximity are at the highest health risk. Recommendations: Prompt efforts are required for relocation of the dumpsite. Novelty: An association between some environmental problems and diseases with distance from the dumpsite informed a dire need to remove the dumpsite from this area. Literature on environmental and health consequences of the dumpsite is scant, jeopardising.*

Keywords*: Environmental pollution, municipal solid waste; open dumpsites, public health.*

Role of Space Technology in Waste Management

Rachita Agrawal*
Indraprastha Research Fellow, University School of Law and Legal Studies, GGSIPU, Delhi, India
**Corresponding Author: rachita.agrawal20@nludelhi.ac.in*

ABSTRACT: *The nations are striving to achieve development and advancement in various fields. In this process, there is a lot of waste that is generated. There exists variability between developed, developing and under developed nations in terms of waste quantity generated. The inability to manage waste is hindrance in sustainability and stable growth. There are locations with standalone hills made-up of human generated waste, depicting the pitfalls in management. The need of innovative and crafted approaches is need of the hour. The utility of advanced space technologies could be used as an intensive tool for reshaping the waste management system and conserving the ecological balance. This research paper through doctrinal research method complimented by case studies attempts to analyses the possibility of integrating space technologies in waste management. The research provides significant perspective on adopting novel approaches for attaining sustainable development and achieve SDG goals through streamlining waste management process.*

Keywords*: outer space, technology, waste management, sustainability, development.*

EcoSort: A Smart Approach to Waste Segregation and Organic Composting

Dhanashree Ghuge*, Niraj Gahukar, Atharva Bhavsar, Apurva Dabhade
Vishwakarma Institute of Information Technology, Dept. of Electronics and Telecommunication engineering, Savitribai Phule Pune University, India
**Corresponding Author: dhanashree.22310073@viit.ac.in*

ABSTRACT: *Household waste is becoming a growing concern, and its disposal creates further hurdles. A functional outline of this project is an innovative automatic waste sorting and composting system meant for domestic implementation. The system is equipped with ultrasonic and moisture sensors, which help in the effective segregation of waste. Ultrasonic sensors determine the nature of the waste being collected, whether it is dry or wet, while moisture sensors in the collected waste measure its moisture level to indicate the prime conditions for composting. Two door control servo motors are incorporated in the design to perform this operation whereby dry waste is moved to a dry waste storage chamber while wet waste is diverted into a composting chamber. All composting system strives to convert organic waste materials into nutrient-rich compost, enhancing soil quality for landscaping and gardening promoting sustainable and eco-friendly lifestyle. The other dry waste storage compartment is meant to hold dry waste materials until proper disposal or recycling takes place. This automated system not only upgrades the ineffective waste sorting approaches but also it encourages households to adopt well-suited waste management practices leading to a long-term positive environmental impact. It is clear that the implementation of this setup will boost waste reduction from landfill sites seeking to promote circular economy at community and regional level. The system is designed with ease of use and efficiency in mind, minimizing the need for human intervention and reducing the likelihood of errors associated with manual waste sorting.*

Keywords*: Waste segregation, Composting system, Automation, Sustainable practices, Circular economy.*

Waste Management in Urban Heritage City Cores: Challenges and Solutions for Sustainable Conservation – A Case Study of Panchavati, Nashik

Aksa Varghis Kondoor*
Acharya's NRV School of Architecture, Bangaluru, India
**Corresponding Author: aksa2449@acharya.ac.in*

ABSTRACT: *Waste management in urban heritage city cores involves balancing the demands of preservation and development with sustainable urban waste solutions. Using the historic core of Panchavati, Nashik, as a case study, this paper explores key challenges and potential solutions that honor both cultural heritage and environmental needs. The study examines the application of the circular economy model and other sustainable frameworks, proposing tailored waste management strategies that respect heritage constraints while fostering community engagement and ecological sustainability. By addressing the socio-cultural dynamics, such as local traditions and community practices, that intersect with environmental concerns, this research offers actionable insights and practical strategies for integrating waste management with heritage conservation, particularly in the context of ongoing urbanization.*

Keywords*: Circular Economy, Sustainable Frameworks, Community Engagement, Socio-Cultural Dynamics, Heritage Conservation.*

A Novel Web-Based Application for Sustainable and Integrated Municipal Solid Waste Management Facilities in India

Rakesh Tejavath[1,2], Ajay Kothari[3], Manogna Reddy[2,*], Brajesh K Dubey[1], Subhankar Karmakar[3], Vinay Yadav[2]
[1]Environmental Engineering and Management, Department of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur, West Bengal, India
[2]Vinod Gupta School of Management, Indian Institute of Technology Kharagpur, Kharagpur, India
[3]Environmental Science and Engineering Department, Indian Institute of Technology Bombay, Mumbai, India
**Corresponding Author: manognareddy@kgpian.iitkgp.ac.in*

ABSTRACT: *The efficient management of municipal solid waste (MSW) is critical for municipalities and municipal solid waste management (MSWM) authorities, necessitating innovative approaches to reduce MSW and optimising its processing and treatment before final disposal. Urban municipalities in India experience substantial issues addressing MSW due to high population, inadequate infrastructure, inefficiencies in the collection, expensive transportation, and lack of awareness of MSWM rules. Effective MSWM is vital for confronting public health and environmental threats, as well as accomplishing sustainable development. The present work proposes a novel web-based tool that aims to assist municipalities and MSWM authorities in making robust decisions about managing a variety of MSW streams efficiently. The tool is structured on a framework that integrates centralised and decentralised solid waste facilities for processing and incorporates updated MSWM regulations. The tool promotes effective and sustainable MSWM strategies by favouring decentralised management everywhere possible and relying on centralised facilities for the last part to enhance resource recovery, therefore minimising social and environmental impacts. The tool assists users in determining the most appropriate solid waste management system for their specific area by considering the classification of MSW, existing systems, efficiency, and other pertinent economic aspects. This work offers a major leap forward in solid waste management, offering realistic and adaptive solutions for urban planners, municipal governments, and MSWM consultants. Furthermore, the online tool has the potential for improvement, such as cost estimation and design aspects, to provide extensive management and execution support. It could eventually minimize waste reaching the final disposal system.*

Keywords*: Solid Waste Management Tool, MSW Management Web Application, Municipal Solid Waste Management, Integrated Solid Waste Management System.*

Applying Big Data Techniques to Analyse Waste Generation Patterns and Optimize Waste Management Strategies

Abhiraj Luther Nanneti*, Shree Charan. C
GITAM University, Hyderabad, India
**Corresponding Author: ananneti@gitam.in*

ABSTRACT: *There has never been a time when finding innovative ways to manage waste sustainably was more important since the global waste crisis is worsening. This study investigates how Big Data Analytics can address inefficiencies in waste management. The primary areas of focus include the optimization of collection routes, the prediction of waste generation, and the improvement of recycling practices. By analysing data from sources such as Internet of Things devices, municipal records, and real-time sensors, we can acquire a more in-depth understanding of the processes involved in waste production and management at different levels. This study identifies trends in various types of waste by utilizing descriptive, predictive, and prescriptive analytics. Additionally, it identifies inefficiencies in the collection systems that are currently in place and highlights opportunities to increase recycling rates. We also deliberate case studies from cities such as Seoul and San Francisco, as examples of places where Big Data has already been successfully implemented, and we draw lessons from their experiences that can practically be applied. The findings demonstrate significant improvements in the efficiency of waste collection, substantial reductions in costs, and significant increases in recycling rates, all of which contribute to a more circular and sustainable economy. Nevertheless, we are also aware of the difficulties that exist, such as concerns regarding the privacy of data and the requirement for improved infrastructure and public engagement. In this paper, the transformative potential of Big Data Analytics is highlighted in terms of its ability to reshape waste management practices to create a more sustainable future. It provides insightful information that can be useful to policymakers, waste management companies, and researchers looking to implement data-driven and sustainable solutions.*

Keywords*: Big Data Analytics, Waste Generation Patterns, Predictive Analytics, Sustainable Waste Management, Recycling Optimization.*

Sustainable Urban Solid Waste Management: A Case Study of Baramati Municipal Council, Pune District, Maharashtra

Sunil Ogale[1,*], Purva Wankhade[2], Sakshi Patil[1]
[1]Vidya Pratishthan's Arts, Science and Commerce College Vidyanagari Baramati, SPPU, Pune University Maharashtra India
[2]Vidya Pratishthan's Biotechnology College Vidyanagari Baramati, Pune District, Maharashtra India
**Corresponding Author: sunilogale@gmail.com*

ABSTRACT: *The Urban areas in India are suffering from the acute pressure of implementing sustainable Solid Waste Management for better environment. From local to global level, various attempts have been made to encounter the problem of solid waste management. This research paper examines the state of urban solid waste management in Baramati Municipal Council, Dist. Pune, Maharashtra, focusing on sustainable practices and challenges. Through a comprehensive analysis of waste management systems, the study identifies key issues of Waste Segregation, Organic Waste Processing, Recycling Initiatives, Waste-to-Energy Technologies, Public Participation and Education etc. The paper also proposes the social, financial and technological aspects for improving sustainability. The findings highlight the effectiveness of current practices procuring financial and social upliftment of the waste pickers and their role in the sustainable waste management policy making. The paper also focuses on the potential for enhanced waste management strategies to address infrastructure, financial, and behavioural challenges.*

Keywords*: Urban, Solid waste management, Sustainability, Segregation, Baramati Municipal Council.*

Role of Project Financing in PPP model Waste Management and other Infrastructure Projects in Oman and the Gulf Cooperation Council Countries

Sree Rama Murthy Y*
Department of Economics and Finance, CEPS, Sultan Qaboos University, Muscat, Oman
**Corresponding Author: murthy@squ.edu.om*

ABSTRACT: *Project financing methods such as BOOT, DBFO, DBO and BOO have been extensively used by the local governments in the Gulf Cooperation Council (GCC) countries. Such financing has primarily been used for establishing water desalination, waste management, electricity generation, roads, airports and other infrastructure. There is an increasing trend towards such methods of financing in recent years in Oman as well in other GCC countries. Public authorities have been set up to develop and regulate PPP type projects. This paper looks at the recent developments in this area in various GCC countries but focuses on Oman in particular. Project financing models such as BOOT, DBFO, DBO and BOO are great ways of putting in place huge infrastructure projects as the funding is primarily from the private sector. The burden of financing on the local government gets greatly reduced as a result of the participation of the private sector. GCC countries have made huge progress using the PPP model both in waste management as well as other infrastructure projects.*

Keywords*:*

Intelligent Biomass Recycling Management System by Enhanced Grey Wolf Optimization Algorithm and Deep Learning

E. Laxmi Lydia*
VR Siddhartha Engineering College (Deemed to be University), Vijayawada, India
**Corresponding Author: elaxmi2002@yahoo.com*

ABSTRACT: *Effective biomass recycling has been identified as a strategic tool in sustainable resource management and environmental protection. Biomass recycling management is herein presented in the form of an intelligent system that employs an Enhanced Grey Wolf Optimization algorithm integrated with a deep learning model to optimize and automate the recycling process. This proposed system incorporates the advanced EGWO to refine and update the recycling parameters with high precision and speed in biomass sorting, categorization, and processing. It can also be equipped with a deep learning model to analyze complex data patterns and predict recycling needs and react dynamically to changes in biomass types and volumes. Experimental results indicate the hybrid approach to be much more efficient than traditional approaches with reduced processing time, energy consumption, and a higher recycling rate. The system offers a scalable, adaptive solution that can be implemented in industrial applications to ensure sustainable biomass management that contributes to a greener, more resource-efficient economy.*

Keywords*: Biomass recycling, Grey Wolf Optimization, Deep learning, Automated management system, Sustainable resource management.*

Need for Infrastructure Development for Solid Waste Disposal in Indian Urban Communities

Nilofar Saifi*, Bandana Jha
Department of Architecture, School of Planning and Architecture, New Delhi, India
**Corresponding Author: nilofar.phd294arch22@spa.ac.in*

ABSTRACT: *The research paper aimed to conduct a systematic literature analysis of the current state of solid waste management in Indian urban residential settlements, identifying challenges, gaps, and potential solutions. India's urban waste management systems are causing chaos due to population density, insufficient infrastructure, unsegregated waste, improper collection, and disposal, posing environmental and public health risks. Due to the high percentage of municipal solid waste creation, density, a lack of awareness, a lack of resources, and inadequate infrastructure, the majority of urban local bodies (ULBs) are unable to handle such a large amount of solid trash. Therefore, effectively reducing solid waste is one of the mandated duties of urban local authorities and municipal corporations. The mixed-method approach integrates systematic review, text mining, and content analysis with a primary case study. It is carried out across a variety of desktop search databases, including Google Scholar, ResearchGate, ScienceDirect, and the Wiley Online Library. It is found that income significantly impacts solid waste content, with low-to-middle-income individuals producing organic waste and high-income individuals producing paper, metals, and glasses, and a correlation exists between geographical position and economic status with waste characteristics. The paper concludes the urgent need for adequate infrastructure, effective treatment, and recycling strategies for solid waste, emphasizing composting as the most environmentally friendly method. Therefore, public perception, willingness to pay, strict laws, social community activities, and regular public campaigns are pillars of effective solid waste management.*

Keywords*: Municipal Solid Waste Management; Treatment; Infrastructure; Environment; Health.*

Youth as motivators for Zero waste initiatives: Approaches, Impacts and Future Potentials

Narendra Chawda[1,*], Balashankar Ramdas[2]
[1]Pacific Institute of Management, Udaipur, India
[2]Pillai Institute of Management Studies & Research, Navi Mumbai, India
**Corresponding Author:*

ABSTRACT: *The goal of the comprehensive zero waste strategy is to reduce waste production and encourage the sustainable use of resources at every stage of their lifecycle. The idea promotes a change from a linear economy, which involves the production, consumption, and disposal of goods, to a circular economy, which places an emphasis on responsible production, recycling, and reuse. The problem gets worser due to the faulty consumption patterns and a lack of general awareness on the waste disposal issue. The young people hold the key to resolving the issue as it is they who will end up dealing with the waste and environmental issues in the future and their expertise in technology will help them come up with creative solutions. Their acumen in use of social media coupled with their quick ability to learn will only help them in this regard. A survey method was used to obtain samples from the youth and 180 samples were submitted. While a Pearson's chi square test was conducted to find relations between demographics and attitutes and behaviours, all other analysis was conducted on the Graphpad prism 10.0 software, mainly One way and two way analysis of variance (ANOVA) and Tukey's multiple comparison test. Some of the findings indicate that though the youth are aware of the zero waste concepts their attitudes and behaviours do not seem to synchronise with some key demographics. The efforts taken to recycle are at best sporadic and they would require a strong backing from the government to obtain the resources which would help them in manageing the zero waste. This kind of help can be delivered through the various arms of the Government itsel or through the NGO's. The education on zero waste has to initiated in their institute where they study to ensure proper training and guidance to manage the issue.*

Keywords*: Zeo waste, Youth, Recycling, motivations, barriers.*

Sustainable Urban Solid Waste Management: A Case Study of Baramati Municipal Council, Pune District, Maharashtra

Sunil Ogale[1,*], Purva Wankhade[2], Sakshi Patil[1]

[1]Vidya Pratishthan's Arts, Science and Commerce College Vidyanagari Baramati, SPPU, Pune University Maharashtra India
[2]Vidya Pratishthan's Biotechnology College Vidyanagari Baramati, Pune District, Maharashtra India
**Corresponding Author: sunilogale@gmail.com*

ABSTRACT: *The Urban areas in India are suffering from the acute pressure of implementing sustainable Solid Waste Management for better environment. From local to global level, various attempts have been made to encounter the problem of solid waste management. This research paper examines the state of urban solid waste management in Baramati Municipal Council, Dist. Pune, Maharashtra, focusing on sustainable practices and challenges. Through a comprehensive analysis of waste management systems, the study identifies key issues of Waste Segregation, Organic Waste Processing, Recycling Initiatives, Waste-to-Energy Technologies, Public Participation and Education etc. The paper also proposes the social, financial and technological aspects for improving sustainability. The findings highlight the effectiveness of current practices procuring financial and social upliftment of the waste pickers and their role in the sustainable waste management policy making. The paper also focuses on the potential for enhanced waste management strategies to address infrastructure, financial, and behavioural challenges.*

Keywords*: Urban, Solid waste management, Sustainability, Segregation, Baramati Municipal Council.*

Investigating the Waste Degradation Efficiency of Bacillus subtilis in the Ayurveda Pharmaceutical Sector: A Sustainable Approach to Waste Management

Prasanna R Kovath, T Angayarkanni*

Department of Biochemistry, Biotechnology, and Bio informatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India
**Corresponding Author: angayarkann_bc@avinuty.ac.in*

ABSTRACT: *The Ayurveda pharmaceutical industry generates considerable organic waste, including herbal residues, oils, and plant extracts, which require efficient management to prevent environmental harm. This study investigates the use of Bacillus subtilis to enhance waste degradation through the production of key hydrolytic enzymes such as amylase, cellulase, and pectinase. These enzymes contribute significantly to breaking down complex polysaccharides, cellulose-rich plant matter, and pectin components found in Ayurvedic waste into simpler, biodegradable forms. The microbial treatment achieved nearly double the degradation efficiency compared to the untreated control. The enzymatic breakdown not only accelerates waste decomposition but also minimizes odor and produces nutrient-rich compost suitable for agricultural applications. Optimizing environmental parameters, such as pH and temperature, further enhanced microbial performance, ensuring faster and more effective waste conversion. The findings suggest that Bacillus subtilis offers a sustainable, ecofriendly solution for managing Ayurveda pharmaceutical waste, promoting circular economy principles by transforming waste into value-added products. This microbial approach provides a viable alternative to conventional waste management practices, reducing environmental impact and contributing to green biotechnology. Further research on scaling up this process and integrating it with existing waste management systems could enhance its practical applicability across the pharmaceutical industry.*

Keywords*: Ayurvedic waste, degradation, Bacillus subtilis, hydrolytic enzymes, value added product.*

Enhancing Adoption and usage of Recycled C&D Waste Products: Stakeholder Insights and Key Success Factors for Effective Implementation

Swarna Swetha Kolaventi[1,*], Aryan Rajesh Thakur[2], Ahaan Narain[2], Sanjay Gokul Venigalla[3]

[1]uGDX School of Technology, Atlas Skilltech University, Mumbai, India
[2]ISME, Atlas Skilltech University, Mumbai, India
[3]ISDI, Atlas Skilltech University, Mumbai, India
**Corresponding Author: swarna.kolaventi@atlasuniversity.edu.in*

ABSTRACT: *Construction and demolition(C&D) activities and natural disasters generate huge quantities of waste materials. A significant portion of this material often ends up in landfills or remains unused. In order to mitigate this, stakeholders' perspectives on the reuse of C&D waste products need to be studied to prevent wastage. Therefore, the current study focuses on the (i)perspectives of various stakeholders (clients, architects, contractors, and engineers) regarding the usage of C&D waste products. The data is collected and analyzed across different stakeholder groups using various statistical tests(ii)In addition, the factors for successful usage of C&D waste products in construction are analyzed using the S-score factor. The results reveal (i)significant differences exist across job roles in familiarity, perceived importance for sustainability, project timeline impacts, willingness to pay, and client demand for recycled C&D materials ($p < 1e\text{-}30$), reflecting varied stakeholder perspectives and experiences. (ii)Quality of recycled C&D materials (S-factor = 64.72) and an efficient supply chain (S-factor = 64.16) are top priorities for stakeholders, with awareness initiatives (S-factor = 62.88) also essential to drive acceptance and informed usage of recycled materials. These findings offer valuable insights for policy-makers and construction professionals to foster greater adoption of recycled C&D materials across the industry.*

Keywords*: Construction and demolition waste, Recycling, Stakeholder perspectives, Sustainability in construction, Construction waste management.*

Feasibility Evaluation of Several Secondary Transfer Stations: A Case Study of Khulna City, Bangladesh

S. Saha[1,*], I.M. Rafizul[1] , Md. Tushar Ali[2]

[1]Khulna University of Engineering & Technology, Bangladesh,

[2]SCIP Plastics Project, Department of Civil Engineering, KUET, Bangladesh

**Corresponding Author: sourav.cekuet2012@gmail.com*

ABSTRACT: *Rapid urbanization in Khulna City, Bangladesh, has resulted in an increasing volume of municipal solid waste (MSW), posing significant challenges for waste management. The city currently relies on a limited number of Secondary Transfer Stations (STS) to temporarily store and transfer waste before final disposal. This study evaluates the feasibility of using Data Envelop Analysis (DEA) through MATLAB and Geographic Information System (GIS)-based location optimization techniques. The data of the STS area, distances of composting and pyrolysis plant, waste composition, transportation cost, waste collection interval, etc. are used for evaluating the technical efficiency of each STS for feasibility. DEA results indicated that the truck terminal STS located in word 18 highest technical efficiency of 0.92 in terms of feasibility study while Rayer Mahal STS located in word 15 shows the lowest technical efficiency of 0.26 which means its suitability for waste composting and pyrolysis is very low. The research involves an in-depth analysis of current waste generation patterns, transportation routes, and operational costs. By analysing various STS scenarios, this study assesses the potential cost savings in waste collection logistics, reduced fuel consumption, and optimized labor usage. Preliminary results suggest that strategic placement of new STS could significantly reduce the overall costs of MSW management while improving service efficiency. This study provides valuable insights for urban planners and policymakers aiming to develop sustainable and economically viable waste management systems and circular economies in rapidly urbanizing cities like Khulna.*

Keywords*: Municipal Solid Waste Management (MSWM); Secondary Transfer Station (STS); Data Envelop Analysis (DEA); Geographic Information Systems (GIS).*

Vermicomposting for Zero Waste: Upcycling Spent Mushroom Substrate and Paper Waste

Hemangi Oza[1], G. Jayanthi[2,*], K. Karthikeyan[3], Shivam Kapoor[4], Mrugesh Desai[5], Shyama Langnecha[4], Falguni Maheshwari[4], Manisha Desai[4]

[1]Charotar University of Science and Technology (CHARUSAT), Changa, India
[2]Environmental Monitoring & Assessment Div., Gujarat Institute of Desert Ecology, Gujarat, India
[3]Gujarat Institute of Desert Ecology, Bhuj, Gujarat, India
[4]Environmental Engineering Department, Government Engineering College, Bhuj, Gujarat, India
[5]Environment Cell, Meghmani Industries Ltd., Ahmedabad, India

**Corresponding Author: jayanthiguide@gmail.com*

ABSTRACT: *India is an agricultural nation, hence more than 50% of solid waste in Indian cities is organic in nature. Therefore, organic waste can be converted to manure through composting which can be further utilized for agricultural activities. Among all composting methods vermicomposting is the best method as it gives best quality manure while lowering pollution and health threats. This study aims to minimize solid wastes by converting organic waste into organic manure through vermicomposting. The paper waste and spent mushroom substrate chosen for the present study was due to their organic nature and nutrient content. Both these materials are easily available and can be decomposed swiftly by earthworms. This method not only reduces waste but also produces a valuable organic fertilizer that can enhance soil health and plant growth. In this study, spent mushroom substrate and paper waste have been composted through earth worm (Eisenia fetida) for 50 days and NPK ratio of both wastes were analysed and compared. This research shows that compost prepared after 50 days through vermicomposting of paper waste (N: P: K Ratio= 1.26:0.04:0.1853) has higher macronutrients content than spent mushroom substrate (N: P: K Ratio= 1.01:0.03:0.05) and this is due to to substrate composition, microbial action, and the breakdown process. pH, temperature, moisture content, C to N ratio are the major factors affecting vermicomposting. The average temperature of paper waste and spent mushroom substrate was 24-34°C and 26-46°C, respectively. The average pH range for paper waste and spent mushroom substrate was 7-9 and 8-10, respectively. This vermicompost from both the waste have been further utilized for gardening and agricultural purposes.*

Keywords*: Solid waste, Vermicomposting, Eisenia fetida, Spent mushroom substrate, N:P:K Ratio.*

The Assessment of the Ecological State of Leachate from the Largest landfill of Georgia and Its Impact on Climate Change

Natela Dzebisashvili[1,2,*], Sadhan K. Ghosh[3], Darejan Dughashvili[1,2]

[1]Institute of Hydrometeorology of the Georgian Technical University, Georgia
[2]Rafiel Agladze Institute of Inorganic Chemistry and Electrochemistry of Ivane Javakhishvili Tbilisi State University, Georgia
[3]Sustainable Development & Circular Economy Research Centre, ISWMAW, Formerly, Mechanical Engineering Department, Jadavpur University, Kolkata, India

**Corresponding Author: n.dvalishvili@gtu.ge*

ABSTRACT: *Situation in the field of municipal solid waste disposal in Georgia over the past decade is remaining at the stage of mixed waste collection and disposal in landfills. This type of MSW disposal has a negative impact on entire ecosystem, due to the formation of large amounts of leachate, methane gas, potential resource depletion and potential to heath hazards. Landfill leads to groundwater contamination, soil & land pollution, harm to animals exposing to harmful materials & foods. Landfills are vulnerable to accidental fires due to the methane produced by decomposing organic waste, financial costs that can be expensive for municipalities or city councils and taxpayers. The aim of this study is to assess the adverse impact of leachate management technology on water resources, as well as on climate change. For utilisation of leachate in this research, the technology of distributing the collected leachate over the surface of the landfill is used. The main objectives include, the study of physical-chemical and microbiological parameters of leachate and the calculation of GHG (methane) emissions from sedimentation systems/tanks/reservoirs of leachate. Physical-chemical and microbiological analysis of leachate water indicates that the concentrations of organic, biogenic and microbiological parameters in research samples exceed limits of discharge by ten times. As a result of this study, for the first time an index of water pollution and greenhouse gas emissions was calculated for leachate of the biggest landfill in Georgia. Leachates belong to class VII according to water pollution index. Emission of methane from leachate for 2024-year estimated as 5% additionally to total methane emissions from the studied landfill.*

Keywords*: Groundwater contamination, Pollutant, Georgia, land pollution, Climate Change.*

Research of uncontrolled landfills impact on environment in the western and eastern regions of Georgia

Nugzari Buachidze, Khatuna Chikviladze, Natela Dzebisashvili*
Institute of Hydrometeorology of Georgian Technical University, Tbilisi, Georgia
**Corresponding Author: n.dvalishvili@gtu.ge*

ABSTRACT: *The proper management of the wastes is one of the important environmental problems of mankind. Taking into consideration that in development countries exist the uncontrolled landfill sites it is obvious that to create necessary measures for the elimination corresponding pollution risks is important strategy for the policymakers [1-6]. Integrated study of abovementioned issues is the scientific novelty of the research.*
In the laboratories the special research was carried to determine the pollution level in the samples collected, which due to the direct impact of these types of landfill sites on the surrounding areas, are often the main polluters of environment. The pollution conditions were studied based on modern methodology and techniques (ISO methods).
The complex chemical, physical-chemical and microbiological study of the research objects were carried. For these purposes the following methods and equipment were used:

1. *Ion-selective chromatograph (ICS-100) ISO100304-1:2007*
2. *Spectrophotometer SPECORD 205 ISO7150-1:2010*
3. *Membrane filtration ISO9308-1, ISO 7899-2*
4. *Plasma-emission spectrometer ICP-MS*
5. *Field portable device.*

The most visible uncontrolled landfill sites were selected in the western and eastern region of the territory of Georgia. Particularly, in eastern Georgia the regions of Kakheti (Sagarejo, Gurjaani, Telavi). have been researched; and in western Georgia Samegrelo-zemo Svaneti (Zugdidi, Martvili, Mestia) correspondingly. Both chemical and microbiological analyses were conducted in the samples taken from their adjacent territories. In case the landfill site is located near the river, during field works using portable equipment main physical-chemical indicators of surface waters were determined. After processing of the obtained results, the corresponding estimations were provided. The risks due to the environmental pollution and negative impacts on population health were assessed.

Keywords*: Uncontrolled landfill, Heavy Metals, Microbiology, Georgia.*

Evaluation of Two-Dimensional Transportation of Metal Ions From An Open Dump Site At Khulna, Bangladesh

K. M. Pangkaj*, I. M. Rafizul

Department of Civil Engineering, Khulna University of Engineering & Technology, Bangladesh

**Corresponding Author: pangkaj1001058@gmail.com*

ABSTRACT: *The process by which pollutants or toxins migrate through the environment, harming ecosystems and human health, is known as "contaminant transport." Understanding these systems is vital for controlling and reducing environmental pollution. Contaminants' destiny includes change, persistence, and final destination in the environment. Contaminants can undergo various types of physical, chemical, and biological transformations, including degradation, dilution, surface adsorption, and organismal uptake. These modifications can influence the contaminant's toxicity, mobility, and persistence in the environment. Transport processes govern how toxins move through many environmental media, including air, water, soil, and biota. Contaminants can be transported through processes like advection, diffusion, and dispersion. The transport of contaminants can be influenced by factors such as environmental conditions, hydrological processes, and the contaminants' properties. The size, shape, density, and solubility of pollutants, temperature, moisture content, and the presence of other chemicals, all affect the destiny and movement of contaminants. Contaminants can travel vast distances by hydrological processes such as rainfall, runoff, infiltration, and groundwater flow. Understanding contaminant transport is essential for assessing environmental risks, designing effective pollution control measures, and developing remediation strategies to protect ecosystems and human health. Advanced modeling techniques, field studies, and interdisciplinary approaches are often used to investigate and predict the transport of contaminants in the environment. This study modeled the groundwater flow and contaminants migration through aquifers beneath the Rajbandh open dumpsite, Khulna, Bangladesh, using MODFLOW and MT3DMS codes. Rajbandh open dumpsite is the only active dumpsite, which was considered the source of contamination. The results will play a vital role in taking necessary steps to monitor the surrounding environment and ecosystem around the existing open dumpsite.*

Keywords*: Contaminant, Open dumpsite, migration, MODFLOW, MT3DMS.*

Life Cycle Assessment of Municipal Solid Waste Management Options in Kathmandu Metropolitan City, Nepal

Samita Khadka[1], Anish Ghimire[2,*], Kedar Rijal[1], Mohan B. Dangi[3]

[1]Central Department of Environmental Sciences, Tribhuvan University, Kirtipur, Nepal
[2]Environmental Engineering and Management, Asian Institute of Technology, Pathum Thani Thailand
[3]Department of Geography and City & Regional Planning, California State University, Fresno, USA

**Corresponding Author: anish-ghimire@ait.asia*

ABSTRACT: *Sustainable municipal solid waste management systems can help to minimise the impacts on human health and the environment. This study evaluated the four possible waste management options or scenarios in Kathmandu Metropolitan City (KMC), Nepal using a life cycle assessment approach (LCA). The four scenarios included baseline or existing waste management scenario (S1), Scenario 2 (S2) considered composting for treatment of organic waste, Scenario 3 (S3) considered anaerobic digestion and Scenario 4 (S4) included the increased recycling rates. The recent information related to the solid waste management situation was collected directly from the KMC office, and secondary literature and government reports were extensively referred to assess the current situation. Key informant interviews were conducted with private waste collection companies as well as with personnel involved in the daily operation. SimaPro (ver. 9.4.0.2) was used for the life cycle assessment of the four MSWM scenarios. The functional unit used was 1 tonne of MSW in the year 2022 was considered. The life cycle impact analysis was done by ReCiPe 2016 v1.1 midpoint, a Hierarchist method. The environmental and health impacts of the scenarios were studied for 18 impact categories showed that increased recycling (scenario S4) can significantly reduce global warming potential (GWP) impact followed by the biological treatment of waste. Results of the sensitivity analysis showed that the diversion of organic waste is important for reducing the GWP due to landfilling (without landfill gas capture). LCA can be a useful tool for evaluating the environmental impact of waste management and can guide the decision-making process for solid waste management.*

Keywords*: Life Cycle Assessment, Solid Waste Management, Environmental Impacts, Decision making.*

Planning for Decentralized Solid Waste Treatment as a means towards Sustainable Waste Management: Case of Patna, India

Rahuk Kr. Rajak*

Department of Architecture and Planning, Indian Institute of Engineering Science and Technology Shibpur, Howrah, West Bengal

**Corresponding Author: 2023apm006.rahul@students.iiests.ac.in*

ABSTRACT: *The City of Patna in Bihar, the 5th fastest-growing city in India, faces significant challenges in the management of its municipal solid waste (MSW) due to rapid urbanization and limited waste processing infrastructure. Patna City generates approximately 775 tons of municipal solid waste daily, of which 47.4% is biodegradable. This paper explores sustainable approaches for treatment of MSW in Patna, focusing primarily on biodegradable waste. The current waste management system practiced in Patna is based on a "Centralized System" in which issues such as increased transportation costs, environmental pollution, and excessive landfilling, leading to more legacy waste, are often observed. This paper focuses on the decentralized waste management system to establish community-level composting and biomethanation plants in Patna's six administrative circles. The objective is to identify suitable locations for treatment of MSW within each administrative circle and create a sustainable waste management model. The process for selecting solid waste treatment method and sites is based on criteria such as availability of open spaces, predominant land use, and population density. The ranking based on these factors will help determine optimal location for setting up the waste processing units. This decentralized model can reduce the burden on the central waste management system and help promote community participation and local resource utilization, further contributing to a more sustainable and eco-friendly environment.*

Keywords*: Biomethanation, Composting, Decentralized Waste Management, Sustainable Solid Waste Management, Waste-to-Energy.*

Evaluation of Socio-Economic and Infrastructural Development of Rural India: A Case Study of Koyali under Unnat Bharat Abhiyan

Shriram N. Kargaonkar[1,*], Sachin S. Zende[1], Suhas Mache[2], P.V. Thatkar[3]

[1]MIT Arts Comm. and Science College, Alandi, Pune, India
[2]Science and Technology, JSPM University Pune, Maharashtra, India
[3]Community Medicine (PSM), PCMC's P.G.I. Y.C.M. Hospital, Pune, India

**Corresponding Author: shriramkargaonkar9@gmail.com*

ABSTRACT: *This research paper provides an analysis of Koyali village in Maharashtra under the Unnat Bharat Abhiyan initiative. It focuses on key socio-economic and infrastructural aspects such as health, education, sanitation, and livelihoods. The study reveals gaps in access to essential services, particularly among marginalized caste groups. While there has been progress in areas like Aadhaar and bank account coverage, significant challenges remain in reducing poverty and effectively implementing government schemes. Health services are inadequate, with only one primary health center serving a population of 3,129, and improvements are needed in water supply, waste management, and drainage systems. The paper aims to highlight the village's current status and inform future development initiatives by using survey data to analyze trends in population demographics, literacy, income disparities, and land use. It underscores the need for more targeted government interventions to improve living conditions in rural communities.*

Keywords*: Koyali village, Unnat Bharat Abhiyan, demographic analysis, sanitation, education, agriculture, government schemes.*

Socio-Economic and Infrastructure Assessment of Markal village under Unnat Bharat Abhiyan: Progress and Challenges Toward Sustainable Development

Shriram N. Kargaonkar[1,*], Seema N. Dokrimare[2], Latpate Sandhya[1], Lembhe Akshata[2]

[1]MAEER's MIT Arts Comm. and Science College, Alandi, Pune, India
[2]Department of Statistics, Dr. D.Y.Patil ACS College, Pimpri, Pune, India

**Corresponding Author:* shriramkargaonkar9@gmail.com

ABSTRACT: *This paper presents a detailed analysis of the Unnat Bharat Abhiyan (UBA) survey conducted in Markal village, Pune district, Maharashtra with an objective to address the development needs of rural India through a comprehensive understanding of socio-economic and infrastructural gaps. The study covers demographic patterns, education, basic amenities, agriculture, livelihood, energy access, health services, and the coverage of government schemes. The findings reveal mixed progress: significant achievements in financial inclusion, electricity coverage, and literacy, contrasted with concerns such as gender disparity in higher education, sanitation challenges, and agricultural dependence on chemical fertilizers. This paper also discusses the implications of these results and suggests potential interventions for sustainable development.*

Keywords*: Unnat Bharat Abhiyan, Markal village, rural development, socio-economic analysis, SDG, agricultural practices, sanitation, financial inclusion.*

A Hybrid Clustering Approaches to Classify IoT-based Big Dataset of Waste Management System

Yun Arifatul Fatimah[1], Ansarullah Lawi[2], Sadhan Kumar Ghosh[3], Zainal Arifin Hasibuan[4,*]

[1]Industrial Technology, Center for Sustainable and Intelligence Circular Economy Universitas Muhammadiyah Magelang, Indonesia
[2]Faculty of Industrial Technology, Institut Teknologi Batam, Batam, Indonesia
[3]Sustainable Dev. & Circualr Economy Research Centre, ISWMAW, & Formerly, Jadavpur University, Kolkata, India
[4]Faculty of Engineering and Computer Science, Universitas Komputer Indonesia, Bandung, Indonesia

**Corresponding Author: zhasibua@email.unikom.ac.id*

ABSTRACT: *Identifying and classifying debris in coastal areas presents a significant challenge due to the dynamic nature of debris movement on ocean surfaces and varying debris types. Debris frequently drifts with ocean currents, some accumulating along the shorelines while others remain suspended near the coast. This diversity complicates accurate classification, with debris types ranging from organic to inorganic, often with considerable variability within each category. Our previous research using unsupervised clustering based on image characteristics yielded limited accuracy, while a fully supervised approach risked losing detail in debris classification. This study proposes a hybrid method that combines unsupervised and supervised clustering techniques to enhance debris classification accuracy. Coastal debris around Batam Island was monitored in real-time using an Internet of Things (IoT) system equipped with cameras and image sensors, collecting large datasets for analysis. Parallel clustering methods unsupervised and supervised were applied, leveraging K-Means for both approaches. The optimal number of clusters in the unsupervised method was determined using elbow graphs and dendrograms, while in the supervised method, clusters were predefined based on debris types. The results from both clustering approaches were compared and integrated to generate robust labels for each debris type, further supporting refined classification and prediction models. Initial findings demonstrate that this hybrid method achieves more accurate classification and prediction than either clustering method alone. These predictive insights are expected to inform optimized debris collection schedules, reduce operational costs, and minimize environmental impact, thereby contributing to sustainable waste management in coastal areas. Future research will explore using these predictions to develop actionable strategies for managing coastal debris effectively.*

Keywords*: Coastal Debris, Waste Management, IoT, Machine Learning, Data Preprocessing, Sustainability.*

The 3R's of Managing Solid Waste

Shaik Kashif Ali*
India
**Corresponding Author: Kashif.personal104@gmail.com*

ABSTRACT: *Waste generation and management is now a very critically debated issue around the world, and through the last few years, this issue has seriously gained momentum. Developed and developing countries are also seeking seriously new and innovative solutions for the mitigation and adaptation of climate change. This is one of the real challenges Bangladesh is currently facing. A very large quantity of waste remains unmanaged and is dumped eventually at unregulated places, thus creating severe environmental hazards. This situation will increasingly affect urban and rural areas as well, and growth centres in Bangladesh will be important for countering climate change. Adopt the 3 Rs—Reduce, Reuse, and Recycle—while giving significant socioeconomic benefits. As a modern method, the strategy is both sustainable for mitigating climatic effects through reduction in greenhouse gases from municipal waste. The 3Rs provide several factors: it is supportive of environmental sustainability; it will help ensure economic resilience for effective waste management; and it underlines effective waste management in the context of climate actions. The problem of waste management is closely associated with broader environmental issues, in this case, climate change. Bangladesh has a highly inadequate approach toward disposing of waste, leading to enormous pollution and health risks affecting communities and ecosystems alike. Unregulated dumping of waste can harm the environment by aggravating the effects of climate change, resulting in a cycle of degradation. This integrated approach can be directed towards changing the waste management activities, which also adhere to the 3Rs, that is, reduce, reuse, and recycle. Reduction at the source level, reuse of materials, and recycling of materials that cannot be reused reduces the amount of communities' contribution towards landfill and GHG emissions. The strategies also support the economy by providing jobs in recycling and waste management sectors, community involvement, and the adoption of sustainability. Ultimately, this 3Rs implementation can strengthen resilience against climate change while keeping public health and the environment healthy throughout Bangladesh and the rest of the world.*

Assessment and Comparison of Compost Varieties with In-vessel Compost Using an Indexing Method for Quality Evaluation

Riyazuddin Shaik, Priyanka Priyadarshini Nyayapathi, Suresh Kumar Kolli, Srinivas Namuduri*
GITAM School of Science, GITAM Deemed to be University, Visakhapatnam, India
**Corresponding Author: snamudur@gitam.edu*

ABSTRACT: *Solid waste generation all over the world increasing day by day with respect to population surge, the composition of solid waste contains bio-waste (food waste, agricultural waste, aqua cultural waste etc.,) glass, metal, plastic etc., the generation of food waste was expected to reach 9 billion by the year 2050 says United nations (UN) Food and Agriculture Organization (FAO). Proper segregation of solid waste at point source can result in reducing environmental stress, contamination issues and also helps in generation of circular economy by converting organic bio-waste to value added product. By comparing physicochemical analysis, pH, E.C., and OC% values in FWC and MSWC reported higher values than CSE 2019, while nitrogen values in FWC and VC reported higher values than standard 6.01% and 2.9%, but C/N values in FWC reported 11.4 below the standard value, while VC and MSWC reported higher values than standard range, FWC's greater OC% than VC's and MSWC's is the cause. The current study aims to evaluate the quality of three compost verities namely vermicompoct (VC), municipal solid waste compost (MSWC), and food waste compost (FWC) using the indexing method. The concentration of heavy metals in VC and MSW was found to be higher than the usual range reported 57.4 ppm of chromium (cr) in VC, 709.7 ppm of copper (Cu), and 23.48 ppm of cadmium (Cd) in MSWC. The compost quality determines its ability to provide essential nutrients, improve soil structure and support healthy plant growth by minimizing or eliminating pathogens and heavy-metal contaminations, by the analysis authors of the present study reports that FWC having high fertility index (FI) score 4/5 and very good clean index (CI) value 5/5 than VC (FI 3.4/5, CI 3.4/5) and MSWC (FI 2.8/5, CI 2.4/5) with the obtained results it determined that FWC having no heavy metal contamination according CSE 2019 standard.*

Keywords*: Centre for science and environment (CSE), Clean index (CI), Food waste compost (FWC), Fertility index (FI), Municipal solid waste compost (MSWC), Vermicompost (VC).*

Exploring Smart Solid Waste Management Practices in Urban Planning: A Literature Review

Tusar Kanti Roy[1], Bhaskar Ghosh[1], Tahdia Tahmid[1], Ashraf-uz-zaman[1], Mumtahina Mantasha[1], Ipsita Saha[2], Sadhan Kumar Ghosh[3]

[1]Department of Urban and Regional Planning, Khulna University of Engineering & Technology (KUET), Khulna, Bangladesh
[2]Dept. of Computer Science and Engineering, Guru Nanak Institute of Technology, Kolkata, India
[3]International Society of Waste Management, Air and Water, Kolkata, India

**Corresponding Author: tusarkroy@urp.kuet.ac.bd*

ABSTRACT: *Innovative approaches to SMART solid waste management (SWM) within urban planning frameworks are required due to the rapid urbanization and rising waste generation. This literature review examines how SMART solid waste management practices are changing, focusing on integrating cutting-edge technologies like the Internet of Things and community involvement for promoting sustainable urban environment. The review identifies key methodologies, technologies, and frameworks currently used in SMART waste management systems, such as using sensors in smart garbage bins and data analytics for waste collection route optimization, by methodically analyzing primary studies published across multiple databases. The results show notable gaps in contemporary technologies, underscoring the pressing need for all-encompassing approaches that improve sustainability and efficiency of waste management. The review classifies research trends, identifies the challenges of implementations, describes new problems, and suggests ways to integrate SMART solutions into urban waste management systems at the policy levels in the future of Khulna City. Urban planners and proponents of universal standards for improving the sustainability and resilience of urban waste management practices in line with global sustainability goals will find important insights in this synthesis.*

Keywords*: Smart City, Internet of Things, Urban waste, SMART solid waste management, Sustainability and resilience.*

A Review on Landfill Site Provision in Land Use Based Urban Area Development Plans

Tusar Kanti Roy[1], Abdullah M. Islam[1], Arfa Morshed[1], Kaniz Fatema[1], Tashdeed Raihan[1], Dineshkumar M[2], Rahul Baidya[3], Sadhan Kumar Ghosh[4]

[1]Department of Urban and Regional Planning, Khulna University of Engineering & Technology (KUET), Khulna, Bangladesh
[2]Department of Mechanical Engineering, Jadavpur University, Kolkata, India
[3]Department of Mechanical Engineering, Institute of Engineering & Management, School of University of Engineering and Management Kolkata, India
[4]International Society of Waste Management, Air and Water, Kolkata, India

**Corresponding Author: abdullahmislam576@gmail.com*

ABSTRACT: *The rising urban population and consequent waste generation intensify the need for sustainable landfill site provision in urban planning. This review synthesizes recent advancements, methodologies, and regulatory approaches to landfill site selection, highlighting the changing landscape of urban waste management. Contemporary planning for landfills employs advanced technologies like Geographic Information Systems, Multi-Criteria Decision Analysis, and fuzzy logic systems that allow the urban planners to evaluate sites based on a set of environmental, social, and economic criteria. Some newer techniques include fuzzy AHP, SVM, and CA-based Markov models, which predict urban growth by offering landfill sites that would be suitable for future expansion. Innovations in sanitary landfill technologies such as bioreactor landfills, augmentation of materials recovery facility, leachate collection system and further reclamation of urban site via landfill mining indicates a great step toward recovering resources and environmental remediation to complement the circular economy. Besides, the reuse of old landfill sites for green spaces is one of the increasing trends, reflecting a holistic approach in the use of scarce urban land in an ecological way. And also, remediation of old landfill site increases the resources recovery which would otherwise have remained locked in the landfill. Despite such development, there are some impediments to progress in reality. Limitations of data, public opposition, and poor integration of sustainability in waste management practices do indicate some critical research gaps. Furthermore, rapid urbanization increases the number of unscientific landfills, particularly in developing countries, because of weak regulatory frameworks and implementation by the authorities, furthermore the frameworks emphasize environmental considerations over socio-economic scenario. Thus, the study addresses these gaps by developing a dynamic participatory planning framework, that balances four pillars of sustainability i.e. ecological (environmental), economical, operational and social sustainability. This review, therefore, provides insight into the ongoing practices and challenges in landfill waste management; hence, it forms a basis for further planning of resilient and sustainable urban landfills in conformity with urban development guidelines.*

Keywords*: Land use, Urban area plan, Sustainable landfill planning, Urban waste management, Environmental remediation.*

Implementing the management of solid waste on islands and coastal areas in Vietnam: A perspective from policy to practice

Nguyen The Chinh*
Institute of Strategy and Policy on Natural Resources and Environment
**Corresponding Author: thechinhnguyen@gmail.com*

ABSTRACT: *The article addresses the issue of implementing solid waste management on islands and coastal areas in Vietnam, viewed from the perspective of policies to practice. It encompasses the Party's directives and orientations to legal regulations, notably the Law on Environmental Protection 2020 and other related policies such as planning. Specifically, the provisions of the Law on Environmental Protection 2020 are detailed through Decree No. 08/ND-CP issued on January 10, 2022, and the guiding circular No. 02/TT-BTNMT issued by the Ministry of Natural Resources and Environment on the same date. The article also highlights current difficulties and challenges in implementing policies related to solid waste management on islands and coastal areas. Based on these insights, it proposes solutions for effective solid waste management on islands and coastal areas in Vietnam that align with practical conditions and the implementation of the regulations set forth in the Law on Environmental Protection 2020..*

Keywords*:*

Integrating waste management practices in tourist destinations: A comparative literature review of successful case studies in India and international contexts

Sushant Jaganade1 *, Ar. G Rajeshwar Rao, Abhishek. Kawale
School of Architecture and Planning, Woxsen University, Hyderabad, Telangana, India
**Corresponding Author: sushant.jaganade@woxsen.edu.in*

ABSTRACT: *This study reviews and analyzes successful waste management strategies in tourist areas, focusing on India and other countries. Tourism drives economic growth, but it also strains local environments, causing waste and environmental deterioration. Sustainable tourism that preserves these locations' ecological and cultural identity requires effective trash management. Using many sources, the research examines how different locations have handled garbage from heavy tourist traffic. This research examines many case studies to determine that legislative frameworks, community engagement, technological solutions, and stakeholder partnerships are crucial to waste management success. The study compares Indian and international waste management methods to show how they are adjusted to local situations yet share similar principles. Swachh Bharat Mission (SBM) has raised awareness of cleanliness and waste management at prominent tourist spots in India, although implementation and sustainability are lacking. In contrast, numerous worldwide tourist locations have sophisticated waste management frameworks that include innovative recycling programs, waste-to-energy technology, and tourist participation in waste reduction. This evaluation provides policymakers, local governments, and tourism stakeholders with best practices and lessons. This study adds to sustainable tourism by examining how successful approaches have been implemented in different contexts and providing a framework to improve trash management in diverse tourist destinations worldwide. The findings emphasize the necessity of waste management in tourism planning for environmental and economic sustainability.*

Keywords*: Tourism, waste management, case studies, literature review, SBM.*

Hedonic Valuation of Energy Efficiency And Solid Waste Management In Residential Real Estate: A Comparative Analysis of Global South Countries

Joyita Naskar[1,*], Damarla Sai Puneeth[2]

[1]Department of Architecture and Regional Planning, IIT Kharagpur, India
[2]School of Architecture and Planning, Woxsen University, Hyderabad, Telangana, India

**Corresponding Author: joyitanaskar13@gmail.com*

ABSTRACT: *This study presents a comprehensive cross-country comparison of the hedonic valuation of energy efficiency features and solid waste management practices in residential real estate, focusing on key Global South countries, including India, Brazil, South Africa, and Indonesia. Using a mixed-methods approach combining cross-sectional and longitudinal analyses, we examine how energy efficiency and solid waste management impact property values across these diverse national contexts. Our findings reveal significant variations in energy efficiency premiums and the influence of solid waste management practices on property values, ranging from 1% to 15%. In India, we observe emerging premiums driven by the country's 2070 net-zero emission target and improving solid waste management systems. South Africa shows promising results with energy efficiency and waste management policies comparable to developed countries, while Brazil and Indonesia demonstrate increasing premiums, especially in rapidly growing urban areas with enhanced waste management practices. Key factors influencing these variations include climate conditions, energy prices, urbanization rates, real estate market maturity, and the effectiveness of solid waste management systems. The study finds that countries with more stringent energy efficiency policies, higher energy prices, and advanced solid waste management practices generally exhibit larger premiums for environmentally friendly properties. This research contributes to hedonic pricing theory by demonstrating the complex, context-dependent nature of energy efficiency and solid waste management valuation in real estate across diverse Global South economies. It provides valuable insights for policymakers and real estate professionals, highlighting the potential for energy efficiency and effective solid waste management as differentiating factors in rapidly evolving housing markets.*

Keywords*: Energy Efficiency, Hedonic Valuation, Residential Real Estate, Cross-Country Comparison, Property Values.*

X'Regulatory and Digital Strategies for Effective KPIs in Waste Management: Case Study in Indonesia

Yun Arifatul Fatimah[1], Maemunah[2], Zainal Arifin Hasibuan[3]

[1]Industrial Engineering Center for Sustainable and Intelligence Circular Economy
[2]Informatic Engineering Universitas Muhammadiyah Magelang
[3]Engineering and Computer Science Universitas Komputer Indonesia

**Corresponding Author: yun.fatimah@ummgl.ac.id*

ABSTRACT: *Indonesia faces complex waste management challenges, with current systems often struggling to meet efficiency and sustainability targets. This study investigates how regulatory policies and digital innovations can jointly enhance Key Performance Indicators (KPIs) for waste management. Traditional approaches lack real-time data integration, leading to inefficiencies in waste collection, sorting, and recycling rates. This research proposes a hybrid approach that combines digital tools including Internet of Things (IoT), sensors, data analytics, and predictive modelling with tailored regulatory frameworks to drive measurable improvements in waste management practices. Through a case study in selected regions of Indonesia, data were collected via IoT-enabled weighting systems to monitor waste flows and analyze key metrics, including collection accuracy, recycling percentages, and landfill reduction. Digital interventions allowed for real-time adjustments in operational processes, enhancing waste data accuracy and resource allocation. Regulatory support created incentives for the widespread adoption of these technologies, fostering a culture of compliance and transparency. Results reveal that aligning regulatory strategies with digital transformation significantly improves KPI metrics, creating a more adaptive and sustainable waste management system. This approach offers a replicable model for other developing nations aiming to achieve waste management resilience. Future research will explore scaling these strategies nationwide, assessing their long-term impacts on environmental and economic sustainability.*

Keywords*: Waste Management, Key Performance Indicators, Regulatory Policies, Digital Transformation, IoT, Data Analytics, Sustainability, Indonesia*

IoT-enabled smart waste management system

B. Sridhar, S. Sridhar*
Lendi Institute of Engineering and Technology, Vizianagaram
**Corresponding Author: Srib105@gmail.com*

ABSTRACT: *As the world increasingly embraces a circular economy, integrating Internet of Things (IoT) technologies into waste management systems offers a transformative solution for sustainability. This paper investigates innovative IoT applications in smart waste management, focusing on real-time monitoring, data analytics, and automation. By utilizing IoT-enabled sensors, smart bins, and connected collection vehicles, cities can enhance waste segregation, reduce operational costs, and improve recycling rates. We present case studies highlighting successful IoT implementations and their economic and environmental impacts. The study also addresses challenges such as data privacy, interoperability, and infrastructure investment, proposing strategies for effective deployment. Ultimately, this research demonstrates how IoT can facilitate a circular economy by optimizing waste management practices, reducing landfill dependence, and promoting resource recovery. The findings underscore the potential of smart waste management systems to contribute to sustainable urban development and engage communities in circular initiatives.*

Keywords*:*

Waste Management and Segregation: Finding Solutions through Public Awareness in Educational Institutions

H. Swer*, W. Kharmawphlang, P. Nongkling, A.J. Iangrai, S.K. Ghosh , R. M.Lyngdoh
Synod College, Jaiaw, Shillong, Meghalaya, North-East India
**Corresponding Author: swerhbs@gmail.com*

ABSTRACT: *Meghalaya is one of the Seven Sister States of northeast India and is known for its lush hills, cascading waterfalls and rich biodiversity. It is also regarded as one of the top tourist destinations in India. However, in the last three decades with rapid economic development, urbanisation, improvement of living standards among the population and especially lack of proper waste disposal and segregation, the city starts facing an ugly garbage crisis. Although in the capital city, Shillong, waste management is governed by the Shillong Municipal Board, yet lack of public awareness and ignorance of the people to abide by the rules and laws implemented by the board and to segregate the waste at source has slowed down in combating this issue. As such, a project on waste management was initiated at Synod College, Shillong in 2021 to reduce the garbage crisis in the state by segregating waste at source at an institutional level. Biodegradable wastes are processed and usable recyclable products are sold thereby, adding to the circular economy. This has promoted an environmental conscious behaviour among the college campus which in turn can disseminate knowledge to the community. As part of the project, Synod college recognizes the significance of addressing this unneglectable issue through public awareness in other educational institutions across the state. Consequently, regular awareness programmes on waste management and segregation were conducted in selected institutions since 2022 followed by the initiation of the waste management project. The college aspires to educate students on waste management and segregation at grassroot level such that it creates a positive impact on the community. Therefore, this paper aims to showcase the initiative taken by Synod college to downscale the stress in landfill sites, reduce environmental degradation and increase the circular economy at institutional level.*

Keywords*: Public awareness, waste management, waster segregation, circular economy, institution.*

Grassroots Participation in Urban Waste Management

T. Geeta Madhuri Naidu*, P. Sobha Rani
GITAM School of Business, GITAM University, India
**Corresponding Author: gtentu@gitam.edu*

ABSTRACT: *One of the foundations of sustainable urban development is effective waste management, yet it often suffers in large-scale rollout due to infrastructure, finance, and involvement by the community. Grassroots involvement has thus been seen as a way forward in resolving these problems with individual members able to take an active role to reduce, collect, and recycle wastes. This paper explores grassroots efforts towards urban management and shows the effect of community-based intervention in addressing the problems of urban waste management. Grass-root approaches promote sustainable practices and instill responsible behavior regarding stewardship among residents through local ownership and accountability. Grassroots success depends on the grassroots communities' awareness, resources, and supportive policy frameworks. Since community-led programs create partnerships with local governments, NGOs and the private sector, they can fill the gaps of municipal service deliveries that currently haven't reached. Low-cost innovation in grassroots efforts adds another dimension to increasing grassroots initiatives adaptability and impact. This, therefore, means that grassroots involvement is not only needed for effective improvement in waste management in the urban area but also for enhanced social cohesiveness and community resilience. The involvement of residents in activities associated with waste ameliorates communal relationships and promotes a sense of responsibility toward sustainability through shared accountability. Grassroots education, incentives to participation, and incorporation of such initiatives into higher-level planning for the urban area create resilient communities responsive to waste management that further environmental sustainability. Grassroots participation becomes the backbone for reaping the fruit of a clean and sustainable city.*

Keywords*: Accountability, Community Resilience, Grassroots Involvement, Sustainable Practices, Waste Management.*

An Impact of Changing Consumption Patterns on Management of Household Waste – A Case Study

Suvarna Sawant[1,*], Pralhad Mudalkar[2]
[1]Bharati Vidyapeeth (Deemed to be University), Pune, India
[2]Bharati Vidyapeeth (Deemed to be University), Institute of Management, Kadamwadi, Kolhapur, India
**Corresponding Author: suvarnasawant81078@gmail.com*

ABSTRACT: *Waste management is an alarming issue addressed globally. It is associated with human health and preservation of nature and natural resources. It has challenges and at the same time endless opportunities also. Waste is a by- product of residential, commercial, and industrial activities. Household waste is a waste generated out of day today activities of households. It is one of the major contributors of municipal solid waste. The rate of production of household waste is very high than its rate of management in urban areas. So, household waste management poses tremendous challenges for the purpose of its safe and ecofriendly disposal. Urban waste management is expensive. Consumption patterns of residents are changing rapidly. Materials used for various activities to fulfil needs and demands of residents are of more complex nature. Disposal of these materials is quite challenging. This is case study research of Vashi Ward of Navi Mumbai Municipal Corporation. The objectives of this research are to know household consumption patterns of residents of Vashi, to study impact of changing consumption patterns on management of household waste and also to study what are the challenges faced by Navi Mumbai Municipal Corporation while managing household waste. A survey was conducted and primary data was collected through questionnaire from residents of Vashi and by conducting in-depth direct personal interview of Sanitary Officer of Vashi ward. The study concluded that there is negative impact of changing consumption patterns of residents on management of household waste. Thus, it creates huge challenges to Solid Waste Management Department of Navi Mumbai Municipal Corporation. So, there is need of rigorous promotion of sustainable consumption patterns to reduce burden of waste management authorities and to protect our environment. This is primary research, which will help Municipal Corporation's Solid Waste Management Department to design promotion strategies to create awareness about sustainable consumption patterns for ecofriendly household waste management.*

Keywords*: Changing consumption patterns, residents, household wate, Vashi ward, Navi Mumbai Municipal Corporation.*

Construction management in BIM in Life Cycle Management

Mohammed Jalal*, Mohammed Abdul Raheem, Mohammed Faisal Uddin , . Zakariya Khan

Lords Institute of Engineering and Technology

**Corresponding Author: zeshan01032003@gmail.com*

ABSTRACT: *Building Information Modelling (BIM) is transforming the construction industry by enabling the efficient management of a building's entire lifecycle, from initial design to demolition. BIM in lifecycle management involves the integration of 3D models with comprehensive data about materials, systems, and processes to facilitate informed decision-making throughout a project's lifecycle. By centralizing all project data, BIM enhances design coordination, enables accurate cost estimation, and supports seamless project execution. Furthermore, BIM extends into the operational phase, allowing for optimized facilities management, predictive maintenance, and future renovations. This approach results in reduced costs, improved efficiency, and sustainability, ensuring that buildings are managed effectively over their lifespan. In lifecycle management, BIM proves invaluable for stakeholders, delivering long-term benefits through enhanced collaboration, data accessibility, and proactive decision-making.*

Keywords*: Building information modeling, Transportation modeling, and design of road and engineering structures.*

A survey report on baby diapers disposal in Indian Context

Khadija Kanwal Khanum*, Bharathi P

B.H. Innovative Research Laboratory, Mysore, India and Alumnae of Indian Institute of Science, Bengaluru, India

**Corresponding Author: : Khadija_khanum@yahoo.com*

ABSTRACT: *This study is based on the impact of diaper disposal in open environment. With the advent of disposable and leak-proof diapers the problem of handling bed wetting and incontinences in both children and elders, alike has been theoretically solved. The disposing of soiled diapers is widely habituated/ carried out along with domestic garbage which are generally thrown in open environment and comes directly in contact with air and water bodies. However, as the domestic garbage (ex: organic matter) starts degrading. The diaper doesn't degrade as the human waste in and on the diaper is encapsulated and held by the polymer layers. Thus, the human waste on the diaper is exposed to prolong period of time to the environment leading to the development of microbes and fungus, and later on infections from it. In Indian context, wherein the waste recycling facilities are still in the development stage, while the usages of diapers and its disposal has exponentially increased, a step towards understanding of diaper disposal on the environment is required. Therefore we conducted a survey and awareness through a set of questions to parents using disposable diapers for their babies, about their experiences in using and disposing the diapers and possible solutions for reduction of diaper waste. The survey details will be presented and summarized.*

Keywords*: Baby diapers, soiled diapers, diapers disposal, waste recycling.*

Optimizing Waste Management Strategies through Ai-Driven Predictive Analytics for A Circular Economy

Suraj Aravind B*
GITAM Deemed to be University, India
**Corresponding Author: sbollapr@gitam.edu*

ABSTRACT: *Waste collection and management are crucial in ensuring a clean and sustainable environment. The transition to a circular economy necessitates innovative approaches to waste management, aiming to enhance efficiency, sustainability and environmental impact. Global waste management challenges stem from the exponential increase in municipal solid, hazardous, and electronic waste. Artificial Intelligence–driven waste management solutions tackle scalability challenges by leveraging automation, data analytics and predictive capabilities; this article proposes a system that uses Artificial Intelligence technologies to optimize waste collection routes, automate sorting processes, and enhance recycling efficiency post-COVID-19 pandemic. This article also delineates the benefits and challenges associated with the proposed system while emphasizing the imperative for improved data quality, privacy measures, cost-effectiveness, and ethical considerations. Machine Learning algorithms are used to analyze historical data to predict waste generation patterns, enabling municipal administration to allocate resources effectively. Mobile applications powered by artificial Intelligence facilitate crowd-sourced waste reporting, enabling citizens to participate actively in waste management efforts. Furthermore, sensor-equipped smart bins can monitor waste levels in real-time and optimize collection routes, thereby improving resource utilization. By leveraging Artificial Intelligence's capabilities in data analysis, pattern recognition, and decision-making, waste management systems can be optimized to enhance efficiency, resource utilization, and environmental sustainability.*

Keywords*: Artificial Intelligence, Waste management, Circular economy, Sustainable environment, Machine Learning.*

Transforming Oman's C&D Waste through Circular Economy

Areen Yousuf Al Khusaibi*
Oman
**Corresponding Author: areenalkhusaibi80@gmail.com*

ABSTRACT: *Oman Environmental Services Holding Company (be'ah) is pioneering Oman's shift towards a circular economy by converting construction and demolition (C&D) waste into valuable resources. As one of the largest waste streams in Oman, C&D waste poses serious environmental and health risks if left unmanaged, contributing to dust pollution, rodent infestations, and illegal dumping. Recognizing these issues, be'ah has taken a proactive approach to mitigate the harmful impacts of C&D waste through structured waste management practices. To address these challenges, be'ah has established 31 dedicated C&D waste collection sites across the Sultanate. These sites accept waste from various construction, demolition, and renovation projects, including homes, buildings, and roads. At each location, materials such as wood, steel, plastics, bricks, and soil are carefully sorted and stockpiled for further processing. In addition, be'ah has designated 9 specialized processing sites, equipped with advanced technology, to transform these materials into eco-friendly products like aggregates and sand. These recycled products are then reused in construction applications, such as block and interlock manufacturing, helping to close the resource loop. A key example of be'ah's circular economy approach is the use of recycled C&D materials in constructing engineered landfills, replacing the need for raw materials in landfill closures. This innovative approach not only addresses waste management challenges but also significantly reduces dependence on non-renewable resources, advancing sustainable infrastructure development and promoting long-term resource conservation. TRANSFORMING OMAN'S C&D WASTE THROUGH CIRCULAR ECONOMY 3 Through these initiatives, be'ah showcases the environmental, economic, and social benefits of a circular economy, establishing Oman as a regional leader in sustainable waste management and setting a new benchmark for effective, scalable solutions aligned with long-term sustainability goals.*

Keywords*: Circular economy, construction and demolition waste, sustainability, recycling*

Swachh Nagar Pariyojna

Shivangi Sultania*
Program, National Graduate School of Engineering
**Corresponding Author: shivangi@cdcindia.org*

ABSTRACT: *Program Overview:*
Swachh Nagar Pariyojna is an innovative waste management initiative implemented by the Centre for Development Communication Trust, aimed at enhancing the cleanliness and sustainability within the Sandila Nagar Palika jurisdiction, Hardoi district, Uttar Pradesh. Funded under the Samuday initiative by HCL Foundation and supported by the Sandila Nagar Palika Parishad, this program addresses the pressing challenges of waste management in 5 wards covering 4430 households and 200 commercials through a comprehensive and integrated approach.
Objectives:

1. *Enhance infrastructure for Door-to-Door waste collection, transportation, street and drain cleaning while reducing garbage vulnerable points.*
2. *Foster responsible waste management practices through campaigns promoting source segregation and reducing plastic usage.*
3. *Establish a self-sustaining waste management system that drives economic growth by processing wet and dry waste.*
4. *Beautify public spaces to improve community well-being.*
5. *Swachhta Nigrani Groups, play a key role in mobilizing households for effective waste segregation and community participation.*

Impact:

1. *Covering 94% households for door-to-door collection, and 74% of them practicing Source Segregation.*
2. *Improved Home & Community level composting and forward linkage for plastic waste with a total of 30490 Kg Waste collected and processed.*
3. *Regular capacity building activities, significant beautification arts and 44 creative installations have installed and 28000 square feet walls painted to increase community awareness.*
4. *7000 reusable cloth bags distributed among the community*
5. *67% of identified GVPs have been eliminated.*
6. *31 Green friends earn stable incomes and receive social security benefits.*

Challenges and Outcome:
Challenges in operationalizing the Material Recovery Facility, as recyclers were initially reluctant to accept low-quality waste. To address this, the program collaborated with recyclers to enhance waste quality through thorough air-blowing, making it more acceptable. Building strong relationships with regional recyclers was crucial for ensuring the program's long-term success and achieving circular economy.

Keywords:

C

Arlen A. Ancheta*

Research Center for Social Sciences and Education The Graduate School, University of Santo Tomas, Philippines

**Corresponding Author: aaancheta@ust.edu.ph*

ABSTRACT: *Waste means different things to many people. It is crafted as a problem to the local government, a resource to the NGOs to be reused or recycled, and a source of livelihood as most of the domestic generated are recyclables. However, we are now confronted with disaster waste. This is the waste generated from strong typhoons and torrential rains that scattered on the streets, rivers, coastal areas, and vacant lots. How does the government address disaster waste after strong typhoon? Based on the concept of circular economy, disaster waste is discussed from the perspective of reusing and recycling. Using qualitative approach, the study used interviews and observations after the storm. Results show that disaster waste generated after devastating typhoons and floodings are transboundary. They move from one place to another following the flow of water. Most of the waste generated are leaves, twigs, branches of trees. If the garbage in the community was not collected, chances are the garbage will go with the floating garbage during flooding events. In conclusion, this calls the attention of the local government to be efficient in garbage collection before the storm and flooding events. The study also calls the attention of the households to be more responsible in segregating garbage before any devastating event takes place.*

Keywords*:*

International Comparison of Economic Incentives for Recyclable Waste Separation and Recycling

Jie Sun; Misuzu Asari*

Research Institute for Humanity and Nature

**Corresponding Author: SUNJIE@chikyu.ac.jp*

ABSTRACT: *A well-designed recyclable waste recycling system raises public environmental awareness and effectively promotes the transformation of green consumption and production models. This study aims to explore the operational mechanisms and models of economic incentives as tools for recyclable waste separation and recycling in multiple countries and to analyze the current operation of waste separation systems and the factors influencing their effectiveness. Through comparative analysis of the advantages and disadvantages of economic incentive-based waste separation and recycling models in different countries, this study hopes to provide valuable insights and recommendations for improving existing waste separation systems. First, the study reviews the literature on economic incentives and waste separation, explaining the role of economic incentives in waste separation systems. Second, it compares the economic incentive for waste separation and recycling models in various countries, including the Deposit-refund system in Sweden, Germany, and the United States; the Pay-as-you-throw (PAYT) system in Korea and Japan; the Waste Bank system in Indonesia; and the Bonus point system in China. By analyzing the strengths and weaknesses of these models, the study further reveals their characteristics and applicability. Finally, the potential of economic incentives is discussed from multiple perspectives, including policies and regulations, management agencies, coverage, funding mechanisms, technological support, stakeholder cooperation, resident participation rates, and recycling rates. Suggestions for improving recyclable waste separation and recycling are also proposed.*

Keywords*: Waste separation and recycling, economic incentive, point system, Deposit-refund system, Pay-as-you-throw*

From Waste to Taste: Characterization of an Underutilized Annona Squamosa Peel Powder

A. Banerjee*, A.C. Lokesh

Faculty of Life & Allied Health Sciences, MS Ramaiah University of Applied Sciences, Bengaluru, India
**Corresponding Author: banerjee.adrita01@gmail.com*

ABSTRACT: *95% of the food consumed worldwide is made up primarily of vegetables and cereals, out of the 7000 food species currently recognized. As a result, indigenous fruits are still underutilized and undiscovered in commercial food markets. Annona squamosa produces edible fruits known as Sitaphal or Custard Apple which is produced in southern and eastern regions of India in large quantities. However, limited commercial presence, lack of processing, and a short shelf life makes these fruit varieties neglected. Annona fruits, including peels, seeds, and pomace, contain phytochemicals, such as alkaloids, carotenoids, polyphenols, flavonoids, and organic acids with nutraceutical and medicinal characteristics, as reported in published studies. This work aimed to conduct a characterization of Annona squamosa fruit peels to determine their potential to be valorized into a functional ingredient in food matrices. The fruit peels were subjected to tray drying, vacuum oven drying and freeze drying. Dried peel powder was obtained which was stored to perform further analysis. Physicochemical, proximate and phytochemical screening of the different peel powders revealed suitability of this by-product to be valorized as a food ingredient. Phytochemical analysis tested positive for important secondary metabolites such as alkaloids, phenols and flavonoids indicating presence of bioactive compounds. Quantitative estimation indicated high amounts of total phenol & total flavonoids in the freeze-dried powder, which indicates a possible antioxidant activity. A preliminary analysis of antibacterial potential using Well-diffusion assay and MIC revealed that the peel crude extracts can inhibit food spoilage bacteria such as Clostridium butyricum. Findings from this study confirms that Annona squamosa peel, which is usually discarded can be an underexplored source of phytochemicals from an agricultural waste and hence might find industrial application in various functional food products.*

Keywords*: Annona squamosa, Phytochemicals, functionality, underutilized fruits, fruit peels.*

Co-Compost – Its Prospects in Agriculture

R. K. Nayak*
Odisha University for Agriculture and Technology
**Corresponding Author: soil@ouat.ac.in*

ABSTRACT: *Co-compost, produced by blending organic waste with faecal sludge, is gaining prominence as a sustainable solution for improving soil health and enhancing agricultural productivity. This innovative approach aligns with circular economy principles by recycling organic matter and nutrients, reducing reliance on chemical fertilizers, and addressing waste management challenges. This paper explores the potential of co-compost in agriculture, focusing on its nutrient-rich composition and environmental benefits. Co-compost offers a balanced mix of essential nutrients such as nitrogen, phosphorus, and potassium while improving soil structure, water retention, and microbial activity. It reduces greenhouse gas emissions associated with conventional waste disposal methods and mitigates soil degradation caused by excessive chemical fertilizer use. Case studies from smallholder farmers demonstrate increased crop yields, reduced input costs, and improved soil resilience with co-compost application. The paper also highlights its role in organic farming systems and its adaptability to diverse agro-climatic conditions. Challenges in scaling up co-compost use, including regulatory barriers, public perception, and logistical concerns, are discussed. Recommendations are offered to address these barriers, including strengthening waste-to-compost initiatives, raising awareness among stakeholders, and providing policy support for co-compost production and application. By integrating co-compost into agricultural practices, countries can enhance food security, promote sustainable farming, and contribute to climate change mitigation, making it a key component in the transition to regenerative agricultural systems.*

Keywords*:*

The efficient management of municipal solid waste

Manogna Reddy*
Vinod Gupta School of Management, Indian Institute of Technology Kharagpur
**Corresponding Author: oyalmanu126@gmail.com*

ABSTRACT: *The efficient management of municipal solid waste (MSW) is critical for municipalities and municipal solid waste management (MSWM) authorities, necessitating innovative approaches to reduce MSW and optimising its processing and treatment before final disposal. Urban municipalities in India experience substantial issues addressing MSW due to high population, inadequate infrastructure, inefficiencies in the collection, expensive transportation, and lack of awareness of MSWM rules. Effective MSWM is vital for confronting public health and environmental threats, as well as accomplishing sustainable development. It necessitates a smart solution that can make precise suggestions for MSWM while considering local and existing criteria. The present work proposes a novel web-based tool that aims to assist municipalities and MSWM authorities in making robust decisions about managing a variety of MSW streams efficiently. The tool is structured on a framework that integrates centralised and decentralised solid waste facilities for processing and incorporates updated MSWM regulations. The tool promotes effective and sustainable waste management strategies by favouring decentralised management everywhere possible and relying on centralised facilities for the last part to enhance resource recovery, therefore minimising social and environmental impacts. The tool assists users in determining the most appropriate solid waste management system for their specific area by considering the classification of MSW, existing systems, efficiency, and other pertinent economic aspects. This work offers a major leap forward in solid waste management, offering realistic and adaptive solutions for urban planners, municipal governments, and MSWM consultants. Furthermore, the online tool has the potential for improvement, such as cost estimation and design aspects, to provide extensive management and execution support. It could eventually minimize waste reaching the final disposal system. Keywords: Solid Waste Management Tool, MSW Management Web Application, Municipal Solid Waste Management, Integrated Solid Waste Management System.*

Keywords*:*

Importance of Data Accuracy and Transparency for Industrial Development Projects: Solid Waste Industry Case

Maria Liubarskaia*, Maksim Lesovoy

Russian New University, Moscow, Russia
Tver State Technical University, Tver, Russia
**Corresponding Author: Lioubarskaya@mail.ru*

ABSTRACT: *In the modern world, information plays a significant role in various spheres. The level of development of both individual enterprises and territories as a whole is determined by how effectively information is used. First of all, the relevance and transparency of information is important for the successful implementation of industrial development projects. For example, the growth of the waste management sphere at the present stage is associated with the development and implementation of projects at all levels: corporate, local, regional, national. These projects are aimed at the construction of new, modern solid waste landfills, waste processing plants and the production of secondary materials. Collection and structuring of information on the tonnage of generated waste broken down by fractions is important for managers and design engineers when planning enterprise capacities. An accurate project budget is important for investors planning to participate in the project, including reasonable planning of the expenditure and income part. Both the amount of investment in the project and its payback period depend on this. For project participants, transparency of information and the exchange of available data allows for smoother interaction and effective risk management. Users of the project results need to receive constantly updated data of both financial and non-financial nature. Successful operation of enterprises is possible only with their financial stability, but at the same time, the social and environmental effects should not be forgotten. This includes such concepts as the level of negative impact of the enterprise on the environment, the creation of new high-tech jobs in the region and the supply of environmentally friendly materials and products to the market.*

Keywords*:*

Benefits of using green elements in building construction –A Perspective as a home buyer in Hyderabad

Venkata Padmavathi Pathaballa*

KLU, Research Scholar, KL University, Guntur District, Andhra Pradesh, India
**Corresponding Author: padmavathipv71@gmail.com*

ABSTRACT: *The integration of green elements in building construction has become a pivotal approach to Sustainable development, addressing environmental, economic, and social challenges. These green practices, which include energy-efficient designs, the use of renewable materials, green roofs, rainwater harvesting systems, and solar energy, significantly reduce the carbon footprint of buildings while enhancing occupant comfort and health. Green elements promote energy conservation, water efficiency, and improved indoor air quality, aligning with global sustainability goals. Moreover, adopting green construction methods results in long-term cost savings through reduced energy and maintenance expenses, while boosting property value and market competitiveness. This deck attempts to present the multifaceted benefits of green elements in building construction, emphasizing their critical role in fostering an eco-friendly built environment and a resilient future.*

Keywords*: Green material, Real Estate, Green Building, Sustainability*

XIX.
Sustainable Development
– Supply Chan – Entrepreneurship - Manufacturing

Design for Remanufacture (DFREM): A Strategic Approach

Ratnesh Kumar Gupta*
Department of Metallurgy and Materials Engineering, NIAMT Ranchi, India
**Corresponding Author: ratneshg@niamt.ac.in*

ABSTRACT: *Design for Remanufacture (DfRem) is a strategic approach in sustainable manufacturing aimed at extending the life cycle of products by facilitating their disassembly, refurbishment, and reuse. This methodology addresses the pressing need for sustainable practices by minimizing waste and conserving resources. Central to DfRem is the design of products that are easy to disassemble, inspect, clean, and reassemble without significant degradation in quality. Key design principles include modularity, standardization of components, and the use of non-destructive joining techniques. DfRem offers substantial environmental and economic benefits. Environmentally, it reduces landfill waste and preserves natural resources by extending product lifespans. Economically, it lowers costs associated with raw materials and energy, while fostering new business models centered on product lifecycle management and service-based revenues. Additionally, DfRem helps companies meet stringent environmental regulations and achieve corporate sustainability objectives. Implementing DfRem requires a shift from traditional design and manufacturing practices, emphasizing collaboration between designers, manufacturers, and remanufacturers. Advanced technologies such as automation, artificial intelligence, and digital twins are crucial in optimizing the remanufacturing process through predictive maintenance, real-time monitoring, and precise control over operations. Challenges to DfRem adoption include the need for standardized design guidelines, economic incentives, and a strong market for remanufactured products. Addressing these challenges involves developing industry standards, promoting acceptance of remanufactured goods, and creating supportive policies and incentives. In conclusion, DfRem is a transformative approach that supports the principles of the circular economy, offering a sustainable pathway to reducing environmental impact and enhancing economic resilience in manufacturing.*

Keywords*: Circular Economy.*

Exploring the Nexus of Luxury Tourism and Sustainability: A Systematic Literature Review

Sabara Soyafuddin Ahmed[1,*], Naziya Aisha[2]
Department of Business Administration, Aligarh Muslim University, Aligarh, India
**Corresponding Author: sabera.ahmad114@gmail.com*

ABSTRACT: *This study aims to provide a holistic and comprehensive picture of the current state of luxury tourism and sustainable consumption research. By employing a strategic review protocol, SPAR-4-SLR, we identified, scrutinized, and synthesized 61 peer-reviewed journal papers published up to May 2024. Using the TCCM framework as a foundation, our systematic literature review delineates and expands on the leading theories, contexts (countries and sectors), characteristics (variables), and methodologies applied to study luxury tourism and sustainable consumption behaviour. We recommend potential avenues for future research using the TMC framework (theory, methodology, and context). Our analysis highlights the need to broaden the discipline's theoretical foundations. Moreover, the existing literature on luxury tourism and sustainable consumption primarily addresses the consumer behaviour-oriented perspective, while the brand or marketer's perspective remains underexplored. This gap suggests that future research should investigate the viewpoints and strategies of brands and marketers within this domain. In addition, future research should broaden existing research methods to uncover distinctive evidence pertaining to luxury tourism and sustainable consumption behaviour. Given that luxury tourism and sustainability is a multidimensional and broad concept, it necessitates diverse methodological approaches. Expanding the range of methodologies can lead to more comprehensive insights and a deeper understanding of the dynamics at play. Overall, this study emphasizes the importance of diversifying both theoretical and methodological approaches in the study of luxury tourism and sustainable consumption. By addressing these gaps, future research can provide a more robust understanding of how luxury tourism intersects with sustainable consumption practices, benefiting both academic research and practical applications in the industries.*

Keywords*: Luxury Tourism, Affluent Tourism, Sustainable Consumption, Ethical Consumption, Literature review cling*

The Role of Supply Chain Sustainability in Supporting Airport Service Providers during Payment Delays from Nigerian Domestic Airlines

Sagir Yaqub Abubakar*
Skyline University Nigeria, Nigeria
**Corresponding Author: sageersys@gmail.com*

ABSTRACT: *This study investigates the critical role of supply chain sustainability in mitigating the impacts of payment delays from Nigerian domestic airlines on airport service providers. Payment delays pose significant challenges to airport operations and service providers, affecting cash flow, operational efficiency, and service quality. Through a qualitative approach involving interviews and case studies with key stakeholders in the aviation sector, this research examines strategies employed by airport service providers to sustain operations amidst payment delays. Key findings highlight the importance of robust supplier relationships, flexible financial planning, and effective risk management strategies in enhancing supply chain sustainability. Airport service providers leverage collaborative partnerships and transparent communication channels to negotiate payment terms and mitigate financial risks associated with delayed payments. Additionally, sustainable practices such as energy efficiency initiatives and waste reduction programs contribute to cost savings and operational resilience. The study underscores the role of regulatory frameworks and industry standards in promoting fair payment practices and supporting sustainable supply chain management. Recommendations include policy interventions to enforce timely payment obligations and industry-wide initiatives to foster a culture of payment reliability. This research contributes to the discourse on supply chain sustainability in the aviation sector, offering insights into effective strategies for airport service providers to navigate financial uncertainties and maintain operational continuity in challenging environments.*

Keywords*: Supply Chain Sustainability, Airport Service Providers, Payment Delays, Nigerian Domestic Airlines, Aviation Sector*

Empirical Analysis of Social Entrepreneurs' Satisfaction in an E-Government Services Context: The Mediating Role of Social Performance

Gangadhara, J.P. Senthil Kumar*
GITAM School of Business, GITAM (Deemed to be) University., Bengaluru, Karnataka, India
**Corresponding Author: sjayapra@gitam.edu*

ABSTRACT: *The current research study aims to investigate the relationship between social value creation, social impact, social innovation and social performance in framing social entrepreneurs' satisfaction in enhancement of rural and remote area sustainable livelihood people through serving e-government services to rural and remote area people. Design/methodology/approach: By employing quantitative research and convenience sampling methods, 365 self-reported survey primary data collected through online questionnaire form e-governance based social entrepreneurs in Karnataka state of India. Partial least square based structural equation modelling employed to empirical data analysis and path hypothesis testing. Findings: The current research study findings suggest that social impact, social value creation, social innovation significantly influence social performance towards social entrepreneurs' satisfaction. Furthermore, social performance significantly mediates the path relationship between social impact, social value creation, social innovation and social entrepreneurs' satisfaction. Implications: These research findings explore the theoretical relationship between the social value creation, social impact, social innovation, social performance in an e-government service context. Practical implications suggest that governments, appointing agencies, rural social communities and e-governance social entrepreneurs to frame sustainable policies, schemes and create awareness about e-government services to improve rural citizens livelihood enhancement. Originality/value: The current research study first research study to explored the factors that influence social entrepreneurs' satisfaction in improving rural citizens sustainable livelihood through e-government services. Keywords: Social Entrepreneurship; E-government Services; Social Impact; Social Value Creation; Social Performance; Social Innovation.*

Keywords*:*

Mitigating Challenges Faced by Women Entrepreneurs: Enhancing Entrepreneurial Self-Efficacy Through Sustainable Entrepreneurship

Sara Elias*, Sharmila Asraf
School of Commerce, Jain (Deemed- to - be University), India
**Corresponding Author: sara_elias@cms.ac.in*

ABSTRACT: *Women entrepreneurs are essential drivers of socio-economic development, contributing to job creation, economic growth, and innovation. Their businesses not only foster community development but also inspire societal change and challenge traditional gender norms, advancing gender equality and prosperity. Despite their critical role, women entrepreneurs face numerous challenges, including technological barriers, limited access to finance, restrictive societal norms, and complex legal and regulatory environments. This research seeks to identify these key challenges and explore strategies to overcome them, with a focus on sustainable entrepreneurship. By addressing these obstacles, the study aims to enhance Entrepreneurial Self-Efficacy among women while promoting practices that support both business success and environmental sustainability. The research emphasizes understanding the specific barriers to progress and offers actionable recommendations for creating a more supportive, sustainable ecosystem in which women entrepreneurs can thrive.*

Keywords*: Technological barriers, limited access to finance, societal norms, legal and regulatory challenges, Entrepreneurial Self-Efficacy, sustainable entrepreneurship.*

Sustainable Finance Landscape: A Study

Souvik Banerjee*
Management Development Institute Murshidabad, Murshidabad, India
**Corresponding Author: souvik banerjee*

ABSTRACT: *As financial services are well-positioned to contribute to the transformation required for sustainable recovery post Covid 19 pandemic, sustainable finance is under renewed focus. Overall, technology is instrumental in mainstreaming sustainable finance by empowering investors with better information, streamlining investment processes, and aligning financial decisions with environmental and social goals. Sustainable finance takes social considerations into account by investing in projects that support social well-being, such as affordable housing, healthcare, education, and community development initiatives. By generating market liquidity through the acquisition of capital from mutual funds, hedge funds, and pension funds, institutional investors can play a significant role in sustainable finance. It is essential to use the untapped potential of sustainable funding to fund environmentally friendly activities given the alarming rise in pollution levels around the world. Mixed financing is necessary to reduce the total cost of capital for private investors.*

Keywords*: Financial Services, Sustainable Finance, Pollution, Untapped Potential.*

Analysing Sustainability Legislations, Policies and Paradoxes for the Individual Transportation Ecosystems: Comparing India and Germany

Monica Khanna[1,*], Dirk Hartel[2], Satyendra K Upadhyay[1]

[1]K J Somaiya Institute of Management, Somaiya Vidyavihar University, Mumbai, India
[2]Baden-Wuerttemberg Cooperative State University, DHBW Stuttgart, Germany

**Corresponding Author: monicak@somaiya.edu*

ABSTRACT: *There is an urgent need to balance growth with sustainable living.*

India with population base of 1.4 billion was globally the fifth largest economy in 2023 1 and among fastest growing economies, leading to increasing consumption of goods and services. There has been rise in ownership of individual transportation vehicles like cars and bikes including electric and hybrid versions, resulting in increased vehicular traffic jams while simultaneous enhancement of air pollution, leading to unsustainable living conditions. The paradox is that India is the 8th highest polluted country in the world 2 with 9 out of top 10 polluted cities worldwide 3 belonging to India. Germany with population base of 83 million was globally third largest economy 4 but also the 3rd cleanest country 5 in 2023, representing best of industrialisation growth and practices. This research paper compares India with Germany in individual transportation sector including macro and micro factors influencing ownership patterns of cars and bikes, Govt policies regarding fuel types and emission norms, new emerging technologies, end of life vehicle scrappage policies, consumer awareness of air pollution and its health hazards due to fossil fuels, and readiness to adopt sustainable transportation solutions. The outcomes of this research would help move towards net zero economies. Stakeholders would benefit from this in-depth and critical analysis to plan future roadmaps of action.

Keywords*: Balancing growth and sustainable living; sustainability legislations, policies and paradoxes; individual transportation ecosystems; net zero economies; comparing India and Germany.*

Sustainable Development Model through De-Carbonisation Process using an iDT Approach

P. Kolluru[*], S.S. Nudurupati

GITAM University, Visakhapatnam, India

**Corresponding Author:* kpaniendra@gmail.com

ABSTRACT: *At the backdrop of the COP-28 summit in Dubai that saw the discussion on Green House Gases (GHG) emissions, there lies a need for a novel hypothetical framework of a Carbon-Free Aluminium value chain under a certain logistical network using an iDT model. There is also a need to address GHG emissions through the UN offset program using Digital Technologies and cost mitigation strategies that follow the Government and UN climate regulations targets in the aviation sector. Although there is widespread interest in addressing GHG emissions, there exists an empirical carbon management and reporting framework through a case-based value chain. Hence, this study aims to develop a sustainable framework using iDT for decarbonising processes in the specific industry. The study will use a systematic literature review to explore decarbonisation processes in the industry. It focuses on logistical modes utilising strategic bunker hub concepts to facilitate this process. The study will evaluate the use of such tools and methodologies in developing a sustainable framework across the value chain using a case-based approach.*

Keywords*: ICAO, IMO, Carbon-Free Aluminium, UN Offset Program, Canada.*

Exploring the Link Between Job Satisfaction and Organizational Sustainability Performance: A Systematic Literature Review

Km Nidhi Singh*, Anand Pd. Sinha
Department of Management, BIT Mesra Ranchi, India
**Corresponding Author: singhnd473@gmail.com*

ABSTRACT: *Organizational sustainability has become a critical priority for businesses worldwide as they strive to balance economic, environmental, and social performance. Simultaneously, employee job satisfaction has emerged as a crucial factor in shaping organizational outcomes. Despite the potential interconnections between these two important constructs, the academic literature has yet to comprehensively explore the relationship between job satisfaction and organizational sustainability performance. This systematic literature review addresses this research gap by synthesizing the existing empirical evidence on the link between job satisfaction and various dimensions of organizational sustainability. Drawing on relevant theories, such as Herzberg's two-factor theory, the natural resource-based view, and institutional theory, the review seeks to uncover the nature and direction of the relationship, as well as the individual-level, organizational-level, and contextual factors that influence this association. A comprehensive search was conducted across multiple academic databases, including Scopus, Web of Science, and ABI/INFORM, to identify relevant peer-reviewed articles published in English. Following the PRISMA guidelines, a rigorous screening process was employed to select studies that met the predefined inclusion criteria. The selected studies were then subjected to a quality assessment and data extraction, focusing on capturing key information related to the research objectives. The systematic review findings indicate a complex and multifaceted relationship between job satisfaction and organizational sustainability performance. While some studies have reported a positive association, others have found neutral or negative relationships, suggesting that the link is contingent on various moderating and mediating factors. At the individual level, employee engagement, organizational commitment, and pro-environmental behaviour emerged as key factors that can strengthen the positive relationship between job satisfaction and sustainability performance. At the organizational level, adopting sustainability practices, a supportive organizational culture, and effective sustainability communication were found to enhance this relationship. Furthermore, the review highlights the importance of contextual factors, such as industry characteristics, regulatory environments, and national cultural values, in shaping the link between job satisfaction and sustainability performance. Certain mediating mechanisms, including organizational citizenship behaviour, knowledge sharing, and innovation, were also identified as potential explanatory pathways underlying this relationship. The systematic review offers several theoretical and practical implications. From a theoretical perspective, the findings integrate job satisfaction and sustainability performance literature, providing a more holistic understanding of the complex interplay between these two constructs. Practically, the review offers insights for organizations seeking to leverage employee job satisfaction to drive sustainable organizational outcomes by implementing targeted human resource management practices and fostering a sustainability-oriented organizational culture. In conclusion, this systematic literature review comprehensively synthesises the existing empirical evidence on the relationship between job satisfaction and organizational sustainability performance. The findings offer valuable insights for researchers and practitioners while identifying key areas for future research to further advance the understanding of this important topic.*

Keywords*:*

Sustainable Manufacturing towards Industry 5.0: A Review

Monal Dutta*
Calcutta Institute of Technology, Banitabla, Uluberia, Howrah, West Bengal, India
**Corresponding Author: monaldutta1982@gmail.com*

ABSTRACT: *The implementation of Industry 5.0 (I5.0) framework for sustainable manufacturing process can integrate resilience for the creation of industrial value. The use of Industry 5.0 (I5.0) framework in various manufacturing sectors improves the demand forecasting through using real-time data and IoT. It helps the industries to reduce overproduction and lead to waste minimization. This strategy falls under the process of intelligent manufacturing by involving existing resources and modern technologies. The concept of intelligent manufacturing was first introduced in Industry 4.0. The production efficiency can be improved by optimizing the traditional business models. The examples of such technologies are artificial intelligence, industrial interconnection and industrial Internet of Things (IoT). Therefore, these technologies are successfully implemented for the up-gradation of manufacturing industries by promoting automation and in various fields of the value chain. The shift from Industry 4.0 to Industry 5.0 mainly encompass the shifting the attention towards environmental benefits for manufacturing development. Hence, the implementation of Industry 5.0 targets towards environmental sustainability to the manufacturing industries. Therefore, it can be concluded that implementation of Industry 5.0 accelerates the intelligent manufacturing process by coupling various soft computing techniques with the existing conventional manufacturing process to enhance the cooperation between human and machine.*

Keywords*: Industry 5.0 (I5.0) framework; Intelligent manufacturing; Artificial intelligence; Internet of Things (IoT); Industry 4.0.*

Sustainable Entrepreneurship Practices in Global Scenario

Shreedeep Gangopadhyay[1,*], Abhisek Karmakar[2]
[1]Calcutta Institute of Technology, Banitabla, Uluberia, India
[2]Consultant at Deloitte USI, Howrah, West Bengal, India
**Corresponding Author: gangaopadhyayshreedeep@gmail.com*

ABSTRACT: *Entrepreneurship is one of the key elements affecting the expansion of the national economy. Because entrepreneurship has the potential to promote positive change and increase economic resilience, it has been the subject of much business research. The "2030 Development Agenda," adopted by the UN, has increased institutional support for sustainable entrepreneurship. The sustainable entrepreneurship is considered to be a component of ecological and social development which is newest tactic that links triple-bottom-line concepts with conventional entrepreneurship. Entrepreneurship is crucial to the transition to a more sustainable future, and it also helps to align social, economic, and environmental objectives with those of ecological entrepreneurs. The purpose of this article is to assess government and industry practices on sustainable entrepreneurship. In order to investigate how SMEs and start-ups might implement sustainability, innovation, and digitalization strategies in the long run, a model that makes use of a variety of estimation techniques is presented. It is observed that while the shift to service-oriented business models has aided in the expansion of sustainable entrepreneurship, cooperation between all parties is necessary to attain the necessary standards of sustainability. Ecopreneurs must implement institutional reforms since the current frameworks favor outdated, unsustainable companies and systems over more modern, sustainable ones. The results of the bibliometric analysis confirmed the growing interest that scholars have recently shown in the connection between sustainability and entrepreneurship. Additionally, the factors influencing entrepreneurship that affect the sustainable development goal (SDG) index in emerging countries were investigated using panel regression, a static model.*

Keywords*: Entrepreneurship; SDG; Ecopreneurs; SMEs; Start-ups.*

Understanding the Challenges Faced by Quick Commerce Delivery Personnel and Optimizing Last Mile Delivery for a Sustainable Supply Chain

Maharaul Padmarajsinh[1], Alex Nero[2,*]

[1]Business architecture senior analyst, Accenture, Bangalore, India

[2]Welingkar Institute of Management Development and Research, Bangalore, India

**Corresponding Author: alex.nero@welingkar.org*

ABSTRACT: *This study explores the challenges and experiences of delivery personnel in the Quick Commerce (Q-commerce) sector, focusing on last-mile delivery operations. As the demand for rapid delivery services surges in India's booming e-commerce landscape, understanding the factors that impact delivery efficiency and customer satisfaction becomes crucial. Last-mile delivery is often the most challenging part of the supply chain, with issues such as incorrect address information, changes in delivery requests, and inadequate packaging leading to delays and missed deliveries. Additionally, vehicle constraints, fuel efficiency, and the performance of delivery management apps significantly affect operational success. With Q-commerce players like Swiggy Instamart, Zepto, Blinkit, and Bigbasket transforming how consumers shop for everyday essentials, the efficiency of last-mile delivery is more important than ever. This study aims to identify the specific obstacles faced by delivery drivers, shedding light on their experiences and how these challenges impact overall service quality. By understanding these issues, we can pinpoint areas for improvement and develop strategies to enhance last-mile delivery operations. Ultimately, this research seeks to contribute to optimizing processes in the Q-commerce industry, ensuring better service for customers while supporting the delivery personnel who make it all possible.*

Keywords*: Quick commerce, optimization, last mile delivery, sustainable supply chain.*

Advantages of Digital Transformation in Retail Leading to a Sustainable Supply Chain

Anjali Shukla[1], Alex Nero[2,*]

[1]GPO (Global Procurement Office), Wipro Ltd., Bangalore, India

[2]Welingkar Institute of Management Development and Research, Bangalore, India

**Corresponding Author: alex.nero@welingkar.org*

ABSTRACT: *Supply chain operations are becoming increasingly competitive in today's fast-changing business environment. Therefore, moving towards digitalization is essential for gaining a competitive edge and improving overall supply chain performance. This study aims to explore how digital technologies can enhance supply chain capabilities and help firms achieve a competitive advantage. Using a survey questionnaire, we collected data from 15 store managers in retail stores. The findings show that digital supply chains play a crucial role in improving supply chain capabilities, which in turn boosts responsiveness and agility. Additionally, the research indicates that digital technology directly contributes to cost reduction and better forecasting accuracy. Overall, the study concludes that integrating digital technology into the supply chain positively impacts agility and flexibility, allowing firms to effectively collaborate with supply chain partners when facing unexpected challenges. In the highly competitive retail industry, adopting digital solutions is vital for survival and profitability.*

Keywords*: Supply chain sustainability, Digital Transformation, Retailer, Technology.*

5G for Smart Resilient and Sustainable Supply Chains – An Exploratory Case Study Research Involving Smart Port

Shantanu Dey*
Information Systems, Gitam Business School, Hyderabad, India
**Corresponding Author: sdey2@gitam.edu*

ABSTRACT: *Supply chains confront significant challenges in building visibility and responding to risks and disruptions while adhering to sustainable development goals. Extant research examines the role of visibility and agility in responding to disruptions and innovation, as well as the safety and community well-being for developing sustainable, smart, and resilient supply chains. The literature also underscores the role of technology in developing visibility and agility in supply chains, with Industry 4.0 defining the emerging technology context that can contribute to sustainable development goals in various forms, including innovation potential, employee safety, partnership, and developing sources of clean energy. Smart ports, the lifeblood of global trade, have been prime candidates for sustainability and resilience studies since their operations can affect global supply chains in multifarious ways. Extant literature, though highlighting the virtue of smart ports and their role in a sustainable world, has not explored how next-generation technology, especially connectivity, can drive smart resilient, sustainable supply chain operations in ports. In this research, we explore the role of 5G as the next-generation connectivity in supply chains and industry 4.0 enabling technology in developing smart, connected ports that are sustainable and resilient by improving visibility, operational agility, and employee safety.*
Design/methodology/approach: We use the theoretical prisms of sensemaking and social capital theory to understand the 5G's pioneering role in developing smart, sustainable, resilient ports. We explore the theoretical model in the context of an in-depth case study of a global smart port through documentary evidence and other secondary data sources and demonstrate how 5G can help define and shape supply chain resilience and sustainability.
Findings: 5G plays a significant role in improving social and cognitive capital by contributing to safety and well-being of port workers and community. It helps in improving sensemaking of complex uncertain situations in port operations, contributing to visibility and agility, improving resilience in global supply chains.
Implications: The research has critical implications for policymakers and practitioners and in advancing theoretical knowledge as it contributes to identifying key technology factors and the role of emerging connectivity technologies in shaping resilient and sustainable ecosystems in the context of the lifeline of supply chains - the ports.
Originality/value: The exploratory research makes a novel contribution proposing 5G as a key enabler of smart sustainable supply chain that significantly enhances supply chain resilience, demonstrating how resilience and sustainability can work in tandem in the context of ports.

Keywords*: Sustainable Ports, Resilient Supply Chain, 5G and next-generation connectivity technology, organizational information theory, social capital theory.*

Looking For Sustainable Development Through Sustainable Investment: A Bibliometric Study

Pranamya A Jain, Ashalatha K[2]*, Tantri Keerthi Dinesh
Justice KS Hegde Institute of Management Nitte, India
**Corresponding Author: ashalatha@nitte.edu.in*

ABSTRACT: *Purpose: Sustainable investing has become increasingly popular in recent years with many large corporations incorporating Environmental, Social, and Governance (ESG) considerations into their core business practices. Responsible investing is largely driven by government regulations and heightened environmental consciousness as policymakers and regulators seek to address the long-term problems of global inequality and climate change and establish a more sustainable basis for the global financial system. Neglecting these elements over time may endanger the supply chain and a company's reputation and stock price. The current study aims to close the gap by examining the performance and trends of ESG and SRI funds in attaining sustainable investment through bibliometric analysis. Design/methodology/approach: The articles were reviewed from SCOPUS using the Biblioshiny tool, and the information was obtained to produce a bibliometric summary. The study was carried out using SCOPUS, a publicly available online database that includes 355 papers with just English as the language. After considering the relevance to the study finally, 301 documents were retained for the Bibliometric study. Findings: Responsible investing has gained importance in recent years and becoming popular because of the government's initiative towards the attainment of SDG by 2030 with a clean environment. The analysis of the study proved that the promotion of these thematic funds undoubtedly will assist in attaining SDG by providing the required sustainability awareness to the investors. Implications: Young researchers can see how mutual fund investments and sustainable investments are connected and how important they are becoming according to the analysis produced from word maps and co-occurrence networks. Further studies can be made on these thematic funds to promote sustainable investment through mutual funds. Originality/value: It is the first Bibliometric study to demonstrate the significance of sustainable and ethical investment for economic expansion.*

Keywords*: Mutual funds, Sustainable investment, Sustainable development, ESG funds, SRI funds.*

Advancing Sustainability through Green Procurement: Practices, Challenges, and Policy Implications

Malla Krishna Prasad*, Suresh. S
GITAM School of Business, GITAM (Deemed to be university), Visakhapatnam, Andhra Pradesh (State), India
**Corresponding Author: kmalla2@gitam.in*

ABSTRACT: *Green procurement, also known as sustainable or environmentally responsible procurement, is an emerging strategy in both public and private sector purchasing that aims to reduce environmental impacts through the selection of goods and services with a lower ecological footprint. This paper explores the concept of green procurement, examining its principles, practices, and benefits for organizations and society. It discusses the motivations behind its adoption, including regulatory pressures, consumer demand for sustainability, and corporate social responsibility goals. The paper also analyses the challenges faced by organizations in implementing green procurement strategies, such as cost considerations, supplier limitations, and lack of standardized criteria. Through case studies and a review of best practices, the paper highlights the impact of green procurement on reducing carbon emissions, promoting resource efficiency, and fostering innovation in sustainable product development. Finally, the paper proposes policy recommendations and strategies for enhancing the effectiveness of green procurement in various sectors, aiming to contribute to global sustainability goals and mitigate climate change.*

Keywords*:*

Can India aspire for a gender-neutral Sustainable Waste Management sector, or will it remain a women-centric livelihood opportunity?

Moumitha Krishnan*, Pushia K P.
India
**Corresponding Author: moumitha.krishna.10@gmail.com*

ABSTRACT: *The United Nations has called upon women worldwide to take the lead role in Climate Action. According to the UN, by becoming active agents of Climate Action, women can tremendously reduce the impact of the Climate Crisis, particularly on themselves and especially the rural and poor women, as they are the main section of society which is unfortunately positioned on the frontlines to face the brunt of Climate Crisis. Historically, many women have actively steward Climate Action by pushing for sustainability and ecological restoration through local and global environmental activism. However, there has been a rise in numbers when poor and vulnerable women have been nudged to collectively participate in building strong communities for community welfare, greening the neighbourhoods, ecological restoration and sustainable development by the government and civil society. Women have always been looked at as agents who are capable of taking up such agendas. Lately, this has been the same with regards to sustainable waste management, such as the waste segregation at the household level or driving the Swachh Bharat or ODF at the community level, or as the lower cadre of municipal waste handling or through their engagement as SHGs in the recycling sector. These forms of involvement project women as the leaders and benefactors of sustainable waste management, thus slowly evolving into a women-centric sector. In this article, we study the evolution of Women's role in Sustainable Waste Management and see if there is scope to aspire for Amartya Sen's 'Capabilities and Positive Freedom' in the case of Women engaged in this sector.*
Key Words: Sen's Capabilities and Positive Freedom Approach, Women Empowerment, Civil Society, Sustainable Waste Management, Climate Action.

Keywords*: Sen's Capabilities and Positive Freedom Approach, Women Empowerment, Civil Society, Sustainable Waste Management, Climate Action*

XX.
Textile Waste Management

Metamorphosis of Textile Waste- Understanding Closed-Loop Management in The Textile Industry

Mamatha G P K*
India
**Corresponding Author:*

ABSTRACT: *"We don't need a handful of people doing zero waste perfectly. We need millions of people doing it imperfectly." — Anne Marie Bonneau*
The textile system operates in an almost completely linear manner, and large amounts of non-renewable resources are extracted to produce clothes that are often used for only a short time, after which the materials are mostly sent to landfills or incinerated. The circular economy offers a transformative approach to addressing environmental challenges within the textile industry, shifting from a linear model of production and consumption to a regenerative system. This chapter explores sustainable practices in textile waste management, highlighting recycling, up cycling, and extended producer responsibility. It examines market trends domestically and globally, identifying the growing consumer demand for eco-friendly products and the role of government regulations. In this study, a comparison between a linear economy and a circular economy is carried out, the risks of linear economy and the advantages of circular economy over it are illustrated, and the implementation of circular economy, an analysis of the implementation of circular economy in textile industries, re-modelling of the industry making changes by creating a multilevel integration model that is most suitable for the circular economy, and the ways by which the end product of one sector can be used as the raw material for another sector by creating a self-sustaining environment and reducing the usage of virgin materials. The textile industry is one of the most polluting industries in the world, and the implementation of a circular economy will help reduce the pollution created by the industry. The understanding of this would create a paradigm shift from fast fashion to a slow fashion movement, which is one of the major trendsetters the industry requires.

Keywords*:*

Pragmatic approach to Dyeing on Cotton Fabric with Recycled Dye Powder Obtained from Dumped Denim Fabric

V R Sampath*, V Kumar, Ziniya Khan
Shri Vaishnav Vidyapeeth Vishwavidyalaya, India
**Corresponding Author: directorsvitt@svvv.edu.in*

ABSTRACT: *Recycling is a method of processing used materials (waste) into new products to prevent environment and to decrease the load on the virgin resource. Recycled textile waste can be further converted in the form of fibre for filling, recycled yarn, recycled woven fabric, recycled non woven fabrics etc. In textile, waste recycling becomes more important phenomenon; bearing in mind the limited availability of resources to produce natural fibres as well as fossil raw materials to make synthetic fibres There are dumped/waste denim fabrics which could be recycled it productive way. The main purpose of this study is to recycle denim fabric in sustainable way by converting the dyed denim garment waste into fine dye powder by various methods and dyeing of 100% cotton fabric and to optimize color yield and assess fastness property of the dyed cotton fabric. In this we extract the dye from the dye powder made from dumped denim fabric and dyed it on cotton fabric. Further the recycled dye powder prepared with various proportions with virgin Vat dye is also tried and optimized the dye proportion.*

Keywords*: — Denim, dumped waste, recycled denim, color fastness.*

Textile Waste and Resources Transformation an Overview

Md. Abul Ala*, Sachi Prasad
National Institute of Fashion Technology, Bhubaneswar, India
**Corresponding Author: abul.ala@nift.ac.in*

ABSTRACT: *The textile industry is widely recognized as a significant contributor to environmental pollution, releasing a substantial amount of pre-consumer and post-consumer waste that often ends up in landfills or incineration sites. Pre-consumer waste, arising during textile production and processing, includes fabric scraps and rejected products, while post-consumer waste comprises discarded textiles at the end of their lifecycle. In India, annual estimates reveal considerable volumes of textile waste, with a notable percentage being improperly disposed of, leading to adverse effects such as greenhouse gas emissions, water contamination, and soil degradation. While the total textile waste produced remains incompletely quantified, estimates suggest that India generates approximately 3,265 kilotonnes of pre-consumer and 3,944 kilotonnes of post-consumer waste annually. Of this, around 326 kilotonnes (1%) of pre-consumer waste and approximately 1,700 kilotonnes (43%) of post-consumer waste are disposed of through incineration or landfill. ([1] Citations- [1]- Fashion for Good. Wealth in Waste: India's Potential to Bring Textile Waste Back into the Supply Chain [Internet]. 2022). Effective management of textile waste is essential to mitigate these environmental hazards. By embracing the principles of the circular economy, textile waste recycling emerges as a pivotal solution to establish a sustainable closed-loop system. Through the implementation of various recycling techniques, including chemical and mechanical processes, waste generated at different stages of the textile lifecycle can be repurposed, thereby reducing its negative impact on the environment. This paper reviews waste that is generated at different levels and in different forms while suggesting diverse recycling methods (mechanical and chemical), utilised to promote textile waste recycling, emphasising the urgency of transitioning towards a circular economy model to enhance textile waste management practices and foster sustainability. The waste might be recycled to make a textile product or might be utilised as a framework for a different industry altogether.*

Keywords*: Waste management, recycling, circular economy, sustainability.*

Designing and Construction of Garments for Preschool Girls using Khadi Fabrics

Yogita Bhatt, Alka Goel, Surya Tejaswi Desu*, C. Manjulatha
Department of Textile and Apparel Designing, College of Community Science, G.B Pant University of Agriculture and Technology Pantnagar, Uttarakhand, India
**Corresponding Author: suryadesu2023@gmail.com*

ABSTRACT: *In today's context, with growing concerns about the impact of cheap fast fashion and the push towards sustainable solutions, Khadi cotton emerges as an ideal option for developing an eco-friendly range of clothing. Khadi refers to any fabric that is handspun and hand woven from cotton, silk, woolen yarns or a blend of these yarns. Known for being "cooler in summers and warmer in winters," khadi offers natural comfort across seasons. This study aimed to design and construct garments from khadi fabric for preschool girls. Designs sourced from various references, shortlisted and then evaluated by a panel of judges based on different parameters such as comfort, self-help features, safety, suitability and overall acceptance. The evaluated designs were further modified using CAD and subsequently used for constructing khadi garments. Among the constructed garments, girl's frock received highest rank based on the weighted mean score in terms of acceptability. These findings could be valuable for manufacturers and apparel firms seeking to explore sustainable fashion options for children.*

Keywords*: Khadi, Comfort, Design, Sustainability.*

Problem and Prospects for Indian Textiles and Clothing on the Path to Sustainability

Manisha A. Hira*, Neha Mehra
Department of Textile Engineering, Veermata Jijabai Technological Institute, VJTI Mumbai, India
**Corresponding Author: mahira@tx.vjti.ac.in*

ABSTRACT: *The Indian textile industry is an important contributor to the GDP of the nation. The nature of textile processes is such that generation of waste during the processes as well as post - consumption is inevitable. The country grapples with managing a staggering 7,800 kilotonnes of textile waste annually, accounting for 8.5 per cent of the global total. The paper highlights the various textile wastes and the possibility of reuse and recycling of the waste in the textile processes. It details the utilization of pre-consumer and post-consumer waste based in their recycling capability. Generally these fibres are sorted and reclaimed to get reusable fibres, which normally are inferior in quality compared to the virgin material. Fast- fashion, difficulty in sorting and collecting the waste and lack of innovative design skills are the hurdles to the path of achieving sustainability in the textile and clothing industry. However, gaining sustainability is a prime goal of the textile industry to reduce the burden on natural resources, especially water resource, reducing environmental pollution and also reducing carbon footprint to tackle global warming. The paper also elaborates on the initiatives taken by the industry and government to tackle the sustainability issues in the textile industry. The initiatives towards sustainability are getting incentivized and sponsored by both manufacturers and other organizations in the textile sector derive benefits of textile recycling. This is evident from the fact that certain textile recycling companies have shown promising growth. A collaborative effort to meet sustainability goals is essential among the manufacturers, users and the regulatory bodies will help to achieve the sustainable path.*

Keywords*:*

Sustainable Textile Waste Management: Paving the Way for a Green Future with Vermiculture Solutions

Daffodil Achsah Miraclyn.S, Aasha Madiq.R, Susila.S, Vasanthy Muthunarayanan*
Department of Environmental Biotechnology, School of Environmental Sciences, Bharathidasan University, Trichy, India
**Corresponding Author: vasanthy@bdu.ac.in*

ABSTRACT: *The present study investigates the vermicomposting potential of Eisenia fetida and Eudrilus eugeniae for treating solid textile sludge waste (TSW) mixed with cow dung in varying ratios over a 120-day period. The vermicomposting process led to a substantial reduction in the carbon-to-nitrogen ratio (66%) and total potassium (51%), alongside increases in electrical conductivity (15%), total Kjeldahl nitrogen (71%), and total phosphorus (19%). Several bacterial genera, including Shigella, Proteus, Micrococcus, Salmonella, and Citrobacter were identified at the conclusion of the process, with microbial populations showing a decrease from initial levels. The study demonstrates that solid textile sludge, when mixed with up to 30% cow dung, is a viable substrate for vermicomposting. FT-IR analysis confirmed the degradation of lipids, carbohydrates, aliphatic and aromatic compounds, indicating successful organic matter transformation in an effective manner. This finding underscore the potential of vermitechnology as an eco-friendly method for managing industrial sludge, offering a sustainable approach that could drive a second green revolution in waste management and environmental conservation.*

Keywords*: TSW; Eisenia fetida; Eudrilus eugeniae; FT-IR; Vermicomposting.*

Eco-Friendly Agrotextiles: Performance Assessment of Ramie, Lyocell, and Cotton Fruit

Manjulatha[1,*], Alka Goel[2], Sanjoy Debnath[2], Ashok Kumar Singh[2], Anita Rani[2], R K Srivastava[3], Ajay Veer Singh[3], S B Singh[3]

[1]G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India
[2]ICAR-National Institute of Natural Fibers Engineering and Technology, Kolkata, West Bengal, India
**Corresponding Author: c.manjulatha709@gmail.com*

ABSTRACT: *The use of non-biodegradable man-made fibres in agriculture has contributed to pollution and solid waste accumulation. This study aimed to develop a sustainable and biodegradable nonwoven fabric from ramie, lyocell, and cotton fibres for use as fruit cover in agriculture. The fibres were selected based on their availability, sustainability, and biodegradability. The physical, mechanical, and comfort properties of the fabrics were also evaluated. Ramie 100% fabric exhibited the highest areal density (147 g/m2), thickness (2.10 mm), air permeability (33.44 cc/cm/sec), and mechanical properties among the three fabrics. Lyocell 100% fabric had the highest thermal insulation value (1.00 tog). A field trial was conducted using the developed fruit cover on mangoes for 54 days. The tensile strength and breaking elongation of the fabrics decreased after exposure to weather conditions, except for the cotton fabric in the cross-direction. This study demonstrates the potential of using natural and biodegradable fibres in agrotextiles to reduce plastic waste generation in agriculture, while providing effective protection against pests, diseases, and adverse environmental conditions. The ramie nonwoven fabric demonstrated superior tensile properties even upon exposure to field conditions, compared to the lyocell and cotton nonwoven fabrics, indicating its potential for utilisation across multiple seasons. The development of sustainable agrotextiles using ramie, lyocell, and cotton fibres offers a promising alternative to non-biodegradable materials, contributing to a more environmentally friendly approach to agricultural practices.*

Keywords*: Biodegradable, Sustainable, Ramie, Lyocell, Cotton, Fruit cover.*

XXI.
Waste Utilization and Recycling

A Study on Reverse Logistics with a Focus on Online Shopping Products

Nimit Sharma[1,*], Ravi Kumar Bhardwaj[2]

[1]School of Commerce, REVA University, India
[2]Import department, DIAGEO, India

**Corresponding Author: ravi.kumar.bhardwaj@ICAI.org*

ABSTRACT: *Reverse Logistics or Upstream of Products and Materials has become a challenge for Supply Chain Management. This research explores the significance, impact, and challenges of Reverse Logistics in Online Shopping, focusing on apparel and other products. The core objective is to analyze online shopping sales returns and suggest strategies for optimizing the associated costs. The methodology involves an identification of the causes of reverse logistics, followed by an analysis of the benefits that reverse logistics can offer businesses. Key techniques include assessing the percentage of reverse logistics across various apparel and other segments. Secondary data is used to conduct a gender-based analysis to determine which segments experience higher return rates. The study findings indicate that a thorough understanding of the reasons behind sales returns and implementing targeted strategies can substantially reduce reverse logistics costs. The study offers practical recommendations for optimizing reverse logistics processes, highlighting the potential for significant cost reductions. Conclusions stress the importance of adopting centralized return centers and supply chain automation to enhance operational efficiency. The implications of this research extend to students, academicians, and industry professionals dealing with reverse logistics challenges. The study contributes to sustainable and efficient supply chain management in apparel and other products by presenting effective cost-optimization techniques.*

Keywords*: Centralized Return Centres, Cost Optimisation, Operational Efficiency, Logistics, Supply Chain Management.*

Durability Properties of Geo-polymer Concrete with Partial Replacement of Fine Aggregate by Waste Crushed Glass

Jami Lakshmi Sudha[1,*], Padmakar Maddala[1], A.Rajendra[2]

[1]Dept. of Civil Engineering, Vignan's Institute of Information and Technology(A), Duvvada, Visakhapatnam, A.P, India
[2]Aditya College of Engineering and Technology, Surampalem, Kakinada District, A.P, India

**Corresponding Author: lakshmisudha@vignaniit.edu.in*

ABSTRACT: *The durability of geopolymer concrete when waste broken glass is utilised in place of some of the fine aggregate was the main focus of this investigation. There is a considerable amount of amorphous silica in the leftover broken glass. Fly ash, waste broken glass, alccofine in a fixed ratio (85% + 15%), alkaline activators, and geopolymer concrete of grade GPC40 were used in the process. Crushed glass waste was added to the GPC40 geopolymer concrete at weight percentages of 0%, 10%, 20%, 30%, and 40% in place of the fine aggregate. For the preparation, ten millilitres of alkaline solutions were utilised. For 7, 28, and 90 days, the samples were cured at room temperature. Testing for durability was done ninety days into ambient curing. The durability testing included half-cell potential and acid attack tests. Solutions with 5% concentrations of sulfuric acid and hydrochloric acid were used for the acid attack tests. The results showed that geopolymer concrete with waste crushed glass (GPC) performed better than regular geopolymer concrete (GPC) in both half-cell potential and acid attack tests. The weight loss and strength loss percentages for the GPC specimens that had 40% of waste crushed glass replaced and were submerged in sulphuric acid were 2.05% and 1.91%, respectively. The results of the immersion tests in hydrochloric acid with 40% replacement showed a weight loss of 3.10% and a strength loss of 1.72%. Furthermore, the half-cell potential data demonstrated a significant correlation between increased glass content and decreased corrosion risk, suggesting that optimizing glass content may be an effective approach to enhancing the corrosion resistance of steel.*

Keywords*: Geopolymer concrete (GPC), Durability Waste crushed glass, Fine aggregate replacement, Amorphous silica, Fly ash, Alccofine, Alkaline activators, Acid attack tests, Sulfuric acid*

Traditional Knowledge and Sustainable Practices: Human Waste Recycling in Ladakh

Shah Khatoon*
Department of Sociology and Anthropology, School of Liberal Arts, Woxsen University, India
**Corresponding Author: Shah.khatoon@woxsen.edu.in*

ABSTRACT: *Human societies have long depended on their ability to adapt traditional ecological knowledge (TEK) for environmental sustainability. Waste management, particularly human waste, poses a critical challenge globally. While modern technology has increased waste production, some traditional societies, like those in Ladakh, India, have continued recycling human excrement as a natural fertilizer. This practice has not only reduced environmental contamination but also enriched the soil in regions where nutrient sources are scarce. However, with the erosion of traditional values due to technological developments, these sustainable practices are at risk of disappearing. This paper explores the human waste recycling practices of Ladakhis, emphasizing their relevance to contemporary waste management. By conserving these indigenous practices, we can develop more sustainable solutions to waste management challenges in ecologically fragile areas. The study also highlights the potential of TEK in addressing broader environmental issues. A qualitative research design was employed, using interviews and participant observation in Ladakhi villages to document local waste recycling practices. Fieldwork was supplemented with archival research, examining historical accounts of human waste use in agriculture. A comparative analysis between traditional Ladakhi methods and modern waste management practices was conducted to assess the ecological benefits of indigenous knowledge. The study uses Political Ecology to analyze the socio-political factors influencing the erosion of TEK. Sustainable Development and Indigenous Knowledge Theory provide additional lenses, focusing on how traditional waste management practices contribute to environmental resilience and sustainability in ecologically vulnerable regions.*

Keywords*: Traditional Ecological Knowledge, Human Waste Recycling, Ladakh, Sustainable Agriculture, Indigenous Knowledge Systems.*

Waste to Wealth Approach Through Various Wastes Substances for Treating Sandy loamy soil on growth and yield of Spinacia oleracea

Sunita Kar*, M. Kiranmai Reddy
Department of Life Science (Environmental Science Division), GITAM School of Science, GITAM, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: skar4@gitam.in, kmajji@gitam.edu*

ABSTRACT: *Sandy soils are those soil which possess sandy or loamy texture with less than 50% of fine sand and may also contain 35% or more rock fragments. In India, the percentage of sandy soil is 4.32%. The foremost problems with sandy loamy soil might be due to its coarse nature which further leads to lower nutrients, and water holding capacity, poor in structure and frequently experiences erosion which could making it less suitable for production of crops. So, to overcome with this problem proper measures should be taken for making it productive with minimum harm to the environment. The study investigated the nutritional potentials of wastes which are organic in nature such as seaweed (Ascophyllum nodosum), poultry manure individually and also with combination in sandy loam soil. Total five treatments were performed including control. The findings showed that combination of seaweed and poultry manure have high moisture content, lower bulk density, and improved water holding capacity when compared to a single addition of manures. The results also showed that the mentioned wastes in the form of fertilizers after application in soil as different treatments improved the soil quality from before sowing to after harvest such as, it improved the soil nitrogen, soil phosphorus, soil potassium along with minor nutrients like calcium, sodium, and magnesium. The growth and yield parameters of Spinacia oleracia has also enhanced with the use of these organic amendments. Notably, organic wastes shown positive results when applied on the field and stays longer in the selected sandy loamy soil for supporting organic fertilizers as sustainable development.*

Keywords*: Organic wastes, Seaweed, Sandy soil.*

Assessment of Composite Plate Experimentally & Numerically

Sudhir Vummadisetti*, Kumar, Lavanya, Bindu Madhuri, Sai Kumar, Uday Kumar

Civil Engineering Department, Vignan's Institute of Information Technology, Duvvada, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: sudhir.civilviit@gmail.com*

ABSTRACT: *This study investigates the impact of varying pH environments on the mechanical properties of jute fiber-reinforced polymer (JFRP) laminates. To achieve this, researchers subjected JFRP specimens to three distinct curing environments - water, acid, and alkaline - for a duration of 28 days. Following curing, the laminates underwent tensile and flexural strength testing to assess the effects of each environment on their mechanical properties. A comparative analysis between cured and uncured specimens was also conducted to evaluate strength retention. The findings offer valuable insights into the behavior of JFRP laminates under diverse pH conditions, highlighting the significant influence of environmental factors on their structural performance. Specifically, the study sheds light on how acidic, alkaline, and neutral water curing affects JFRP laminates, and how these conditions impact tensile and flexural strength. By exploring the durability and reliability of JFRP laminates in various environments, this research informs their potential applications across different industries, providing crucial data for material selection and design considerations. The outcomes of this study contribute to the development of more resilient and sustainable composite materials.*

Keywords*: Jute fibre-reinforced polymer, Mechanical Properties, pH Environments, Curing Methods, Tensile and Flexural Strength.*

Preparation of Geopolymer Bricks Using Fine Granite Waste

Amal M. El-Sayed[1,*], El-Sherbiny S. A.[2], Sh. K. Amin[3]

[1]Chemical Engineering Department, Egyptian Academy for Engineering and Advanced Technology (EA&EAT) affiliated with the Ministry of Military Production, Cairo, Egypt

[2]Chemical Engineering Department, Faculty of Engineering, Cairo University, Giza, Egypt

[3]Chemical Engineering and Pilot Plant Department, Engineering and Renewable Energy Research Institute, National Research Centre (NRC), Dokki, Giza, Egypt

**Corresponding Author: amal.magdy@eaeat-academy.edu.eg*

ABSTRACT: *Among the main challenges nowadays are the energy crisis, lack of resources, and high waste generation rate that has a negative impact on the environment. Both the stone sector (mainly granite and marble industries) and the fired clay brick industry are considered two of the major sources of non-biodegradable solid wastes. By 2025, the global production of stones is estimated to be 450 million tons, of which about 40% by mass is considered waste in addition to the waste generated from the quarrying step. Waste management techniques should be applied to mitigate their negative impact on the environment. In this study, both fine granite waste (FGW) and fired clay brick waste (FCBW) in the powder form are recycled to produce green geopolymer bricks. The characteristics of both FGW and FCBW were obtained through physical, metallurgical, and thermal analyses. Geopolymer blocks were prepared using different granite percentages from 0 to 35%, and activation is performed with the aid of Ca(OH)2 and NaOH with percentages of 8 and 0.5% respectively. These blocks were cured at room temperature for 3, 7, 14, and 28 days, then bulk density, cold and boiling water absorption percent, saturation coefficient, apparent porosity, and compressive strength were determined. The optimum granite percentages were determined according to the American Society for Testing and Materials (ASTM) standards, and they were found to be 5 and 15% after curing for 28 days at the ambient temperature.*

Keywords*: Fired clay brick waste; Geopolymer bricks; Granite waste; Solid waste management.*

Converting waste wood to biochar to lock in generational carbon and reduce nitrate loss in agroecosystem

Britt Fossum, KatjaKoehler-Cole, MichaelKaiser, and ArindamMalakar*
University of Nebraska-Lincoln, USA
**Corresponding Author: amalakar2@unl.edu*

ABSTRACT: *Innovative management strategies like biochar can boost soil carbon storage and optimize fertilizer usage by curbing nitrate leaching, which is needed to enhance agricultural sustainability. Sourcing feedstock from waste wood sources, such as invasive tree species–eastern red cedar, can make biochar production economical. This research evaluates the impact of biochar sourced from eastern red cedar on soil carbon and nitrogen retention in corn-soybean systems with or without cover crops that were rain-fed or irrigated. Applied at 70 Mg/ha in spring 2022 and mixed into the uppermost 10 cm of soil, the effect of biochar was quantified through soil nutrient, carbon, and nitrogen levels. Irrespective of cover crops, biochar significantly raised organic carbon stocks in the top 30 cm of soil. Importantly, biochar proved to be an effective solution in improving nitrate retention, as assessed by residual soil nitrate post-harvest and before planting. No impact on nitrate content in subsoil (below 30 cm) was observed, but more nitrate was retained in the uppermost 30 cm, particularly at the rain-fed site, where it increased by 31±8.0 kg/ha compared to cover crops alone. Under irrigation, nitrate retention soared by 11 kg/ha with adding biochar amendment. Surface analysis of biochar particles via x-ray photoelectron spectroscopy (XPS) revealed nitrogen andiron co-localization with iron species present in 95% of particles exposed to irrigation compared to only 50% of particles under rainfed conditions, suggesting that biochar's surface functionalization might enhance nutrient retention, with water management affecting the rate of this process while enhancing nitrogen retention.*

Experimental Investigation on Degradable and Strength Weakening Characteristics of Arhar Composite

Manubolu Venugopal Naidu[1,*], Diwakar Reddy .V[2], Sadhan Kr Ghosh[3], Bhaskar Reddy .C[4]
[1]Dept. of Mechanical Engineering, R G M College of Engineering and Technology, Nandyal, AP, India.
[2]Department of Mechanical Engineering, S V U College of Engineering, Tirupati, AP, India
[3]Sustaijable Dev. & Circular Economy Research Centre, ISWMAW & Jadavpur University, India
[4]Sri Kalahasteeswara Institute of Technology, Srikalahasti, Tirupati, AP, India
**Corresponding Author: vdrsvuce@gmail.com*

ABSTRACT: *Increasing environmental pollution is a significant concern in the society. Natural fibers have been channelized to produce and fabricate natural composite materials (NCM) using Agricultural Solid Waste, which has already been successfully deployed for numerous heavy industrial sectors applications, such as aviation, transportation, logistic, production industries, automobile, ship buildings, other marine constructions, etc. This study focuses on development of the degradation setup for NCM and the degradation processes to investigate the strength-weakening characteristics of the fabricated NCM. The NCM were prepared based on design of experiments by using Arhar powder as per the literature and tested to get desired mechanical properties, e.g., strength, surface roughness, and other properties. By evaluating output responses using optimizing technique Grey Relational Analysis (GRA) with Principal Component Analysis (PCA), it is found that the best optimum value found at ABS(4%), CMC(12%), and Guar Gum (12%), subsequently the specimen underwent the degradation process. The specimen was tested on a degradation setup to study its degradation characteristics in two different soils, e.g., clayey soil and clayey sand soil. It has been observed that the time taken for sample degradation were different for 9 mm cubical size specimens. The strength weakening test is conducted from 15 to 60 days with a variation of 15 days. It is noticed that the strength of the composite initially increased due to absorption of moisture content in the soil and after 60 days the strength weakened gradually. This study presents significant results of producing or fabricating NCM using agricultural solid waste.*

Keywords*: Natural Composites, Degradation process, optimizing technique, Arhar powder, clayey soil, clayey sand soil.*

Experimental Investigation of Partial Replacement of Coarse Aggregate with Animal Bone and Cement with Bagasse Ash

S. Karthikeyan[1], P. Vasanthi[2], B. Vijaya[3] Priyanka[4,*], R. Swathi Rekha[5]

[1,2,4,5]Dept. of Civil Engineering, Chennai Institute of Technology, Kundrathur, Chennai, India
[3]Dept. of Civil Engineering Dr. M.G.R. Educational and Research Institute Chennai, India
**Corresponding Author: bvijayasuresh@gmail.com*

ABSTRACT: *An exploratory study on the suitability of the crushed animal bones as partial replacement for normal coarse aggregates and partial replacement of sugarcane bagasse ash for cement by 5% in concrete works has been carried out. Physical and mechanical properties of machine crushed animal bones and locally available normal aggregate have been determined and compared. A large number of concrete cubes of size 150×150×150 mm and beams of size 500×100×100 mm with different percentages by weight of normal aggregate to crushed animal bones as coarse aggregate in the order 70:30, 80:20, 90:10 and 100:0 were cast, tested and their physical and mechanical properties were determined. Compressive strength tests and flexural strength test are being done with the crushed animal bones in replacement for normal aggregate were for concrete mix ratio 1:1.5:3. The study has been carried out at 10%, 20%, and 30%, replacement levels of normal aggregate by crushed animal bone (CAB) aggregate by weight and a comparative study has been done between normal concrete and crushed animal bone (CAB) concrete. For control concrete , IS 10262-1982, SP 23 , IS 456-2000 method of mix design is adopted and considering this a basis , mix design for replacement method has been adopted.*

Keywords*: Crushed animal bone, bagasse ash, concrete, light weight aggregate, compressive strength, unit weight*

Utilization of Cow Dung Ash and Ceramic Waste as Partial Substitution for Cement and Fine Aggregate in Concrete

P. Vasanthi[1], B. Vijaya[2,*], P. Partheeban[3], Priyanka[4] , R. Swathi Rekha[5]

[1,3,4,5]Dept. of Civil Engineering, Chennai Institute of Technology, Kundrathur, Chennai, India
[2]Dept. of Civil Engineering Dr. M.G.R. Educational and Research Institute Chennai, India
**Corresponding Author: bvijayasuresh@gmail.com*

ABSTRACT: *As the need for river sand grows and its resource decreases, there is an urgent demand to find alternatives that can partially or fully replace it. The extraction and manufacture of cement creates environmental issues due to the release of gaseous pollutants. In order to remove cement partially cow dung ash is used. The influence of adding Cow Dung Ash (CDA) in five percentages constantly by weight of cement and ceramic waste (CW) adding the various percentage of 15%,30%,45% by weight of fine aggregate. To evaluate the mechanical properties like compressive strength and split tensile strength, CDA and CW were substituted for cement and fine aggregate and cured for 7, 14, and 28 days before testing. Setting time, specific gravity, consistency, and workability of cow dung ash in various percentages were determined by mixing with Portland cement. The results indicated that the ultimate load carrying capability of concrete is increased by using CW and CDA replacement when compared to ordinary concrete.*

Keywords*: Compressive strength, cow dung ash, ceramic waste.*

Energy-Efficient Building Materials based on Natural Waste Generated by Exogenous Processes

Elena Shapakidze[1,*], Rajden Skhvitaridze[2], Nino Mukhadgverdeli[2], Izolda Kamushadze[1]

[1]Ivane Javakhishvili Tbilisi State University, Alexander Tvalchrelidze Caucasian Institute of Mineral Resources, Tbilisi, Georgia.
[2]Georgian Technical University, 77, Merab Costava Str, Tbilisi, Georgia
**Corresponding Author: elena.shapakidze@tsu.ge*

ABSTRACT: *Global warming and tectonic shifts in the Caucasus, in particular in Georgia, caused a violation of gravitational stability in high-mountain regions. As a result of frequent landslide processes, a large volume of solid masses, ready for activation and representing a potential danger to the environment and its inhabitants, has accumulated.*
One of these regions is the southern slope of the Caucasian mountains - the valley of the Duruji River in Kakheti, where more than 20 million cubic meters of gravel have accumulated as a result of natural exogenous processes. These accumulated masses represent loosened clay shales, which can be used in various economic spheres, which will also contribute to their utilization and restoration of ecological balance in the region.
In this direction, the probable areas of use of shale in general are:

- *Agriculture: as fertilizer; it is especially effective in vine growing, used in fine fraction (silt);*
- *Production of glass and enamel: as an auxiliary raw material for container glass, in the production of molded glass and glass products, technical primers and coatings, including anti-corrosion enamel;*
- *Production of ceramics: for production of bricks, roof tiles, finishing slabs, etc.;*
- *Production of cement: as component of raw cement mixture, as well as mineral additive in the process of cement grinding;*
- *Production of construction materials: for obtaining of various expanded materials, for production of light concrete filler - expanded clay and light thermal insulation materials.*

Keywords*: energy-efficient building materials, clay shales, ceramics, expanded clay.*

Thermo Catalytic Conversion of Solid Waste to high Calorific Fuels and Energy

Raghavendra Rao Turlapati*

Polycrack Worldwide Limited, India
**Corresponding Author: trrao@polycrack.com*

ABSTRACT: *Solid waste, be it the MSW, STP waste or industrial waste, is a major problem confronting the global community. Vast amounts of waste generated require innovative solutions. The innovations must be such that the waste is converted into usable, energy rich resources similar to fossil fuels. Replacing fossil fuels with the daily waste generated, would lead to successful achievement of circular economy goals. Waste is the constant in a changing world and no matter how many waste reduction and recycling technologies emerge, waste generation at domestic and industrial sectors would never cease, thus making solid waste, a sustainable source of energy. Carbon recovery and net zero are the requirements of future environmental recovery. A technology that would fulfil the needs of the society, governments, environment and economies is the Thermo Catalytic conversion of waste into usable hydrocarbon fuels having high calorific value, which can be used to generate electricity at source. This technology unlike, biological processes, requires less than 12 hours for full conversion into energy fuels and at the same time recovering carbon from the waste. Thus same day conversion of waste reduces the use of landfills, saving transportation costs and help in achieving zero landfill targets. The modular nature of these plants which can be designed as per the volume requirements of a locality, can help is establishing de-centralised, low cost, at the source waste to energy plants that will help build a robust economic, sustainable source of energy for achieving economic, energy, waste mitigation, circular economy, sustainability, carbon recovery, net zero goals.*

Keywords*:*

Assessment on biochar–Fe2O3–TiO2 composite efficiency of photocatalytic degradation of crystal violet

K. Kishore Kumar [1,2]*, Anna Gnida [1], J. Surmacz-Górska [1], S. Sujatha [3], G. Narasimha[4]

[1]Department of Environmental Biotechnology, Faculty of Energy and Environmental Engineering, Silesian University of Technology, Poland
[2]Dept. of Research and Innovation, Swathy College of Pharmacy, Venkatachalam, A.P, India
[3]Department of Pharmaceutics, Narayana Pharmacy College, Andhra Pradesh, India.
[4]Department of Virology, Sri Venkateswara University, Andhra Pradesh, India

**Corresponding Author: kadimpatikks@gmail.com*

ABSTRACT: *Algae biochar was used for the preparation of Biochar–Fe2O3–TiO2 composite and evaluated the efficiency as adsorbent and catalyst in batch reactor studies on Crystal violet (CV) as model organic compound. The photocatalytic, Fenton and photo-Fenton performances of the samples were investigated by degrading Crystal violet using normal UV-C light. Biochar–Fe2O3–TiO2 composite adsorption was favour at pH 7 and the qmax was noted as 109 mg g-1. The adsorption data can be explained by Langmuir isotherm and followed by pseudo-second order kinetics. Biochar–Fe2O3–TiO2 100 mg (2 g L-1) dosage, pH 7 at 25 □C are the favorable conditions. The photo-Fenton was performed by using the Biochar–Fe2O3–TiO2 on the effect of experimental parameters such as contact time (0–6 h), initial CV concentration (50–300 mg L-1), solution pH (7–10), and biochar dosage (1–3 g L-1) were investigated. The results observed that at pH 7, composite dosage 2 g L-1 on 300 mg L-1 CV, achieved 99% degradation with 0.25 mL of 30% H2O2 and UV-C light (resembles normal sun light). Biochar–Fe2O3–TiO2 was reused for the several times after recycling. Biochar–Fe2O3–TiO2 was characterized by TEM, SEM, EDX, XPS and FTIR. The thermodynamic studies portrayed that and concluded as non-spontaneous, decrease in randomness and exothermic in nature. Successfully regenerated, recovered the Biochar–Fe2O3–TiO2 through magnetic property for five cycles demonstrated the effectiveness achieved 92% at pH 7. The XPS data, showed, the peaks at the binding energy of 707. 45 and 710.42 eV are designated as Fe2+ and Fe3+ respectively of the composite. This is revealed that the continuously forming Fe2+ and Fe3+ in the degradation process. Biochar–Fe2O3–TiO2 is a promising composite for the adsorption and photocatalysis in the presence of normal sun light.*

Keywords*: Magnetic biochar, Crystal violet, XPS, kinetics, photo-Fenton.*

Circular Economy in Construction: A Study on Recycled Tyre Rubber Infused Pavement Blocks

Mohammed Ibrahim H, Bowmitha Parveen S, Aakashraj R B, Revathy S R*, Kirubakaran V

Centre for Rural Energy, Gandhigram Rural Institute – DTBU, India

**Corresponding Author: revathysrajaram@gmail.com*

ABSTRACT: *India's annual tyre production has increased by 12% since 2019, resulting in the generation of 1 million tons of end-of-life tyres. This brings concern about the proper recycling and disposal of tyres to address the associated environmental concerns. This study investigates the reuse of the crumb rubber obtained from shredded tyres as a partial replacement for the aggregate in the concrete pavement block. Pavement blocks with different crumb rubber to aggregate ratios were experimented with to identify the optimal ratio that offers better tensile strength. Additionally, the developed pavement blocks are tested for quality, integrity, tensile strength, durability, water permeability, compression, and flexural strength. The pavement blocks with 10% crumb rubber are found to possess a compressive strength of 66 N/mm2 with a split tensile strength of 2.81MPa and a flexural strength of 14.1MPa after 28 days of molding. It is also found that the crumb rubber-based blocks absorb 5% less water than the conventional concrete blocks. These enhanced properties make the crumb rubber-based tyres a suitable alternative to conventional pavement blocks for urban landscaping and pedestrian pathways. Moreover, the use of crumb rubber contributes to the circular economy by diverting waste tires from ending up in landfills, reducing raw material demand, and promoting sustainability in construction practices. This offers dual benefits of waste reduction and resource conservation. This can also empower the tyre manufacturers to co-produce such pavement blocks, thus fostering a circular economy, new job creation, and adherence to the EPR stipulations of the CPCB.*

Keywords*: Crumb rubber, Concrete Pavement Blocks, Sustainable Construction, Circular Economy, and Waste Reduction.*

Exploration of Used Engine Oils in Clay Bricks Fabrication

Sh. K. Amin[1]*, S. K. Ghosh[2], S. I. Hawash[1]

[1]Chemical Engineering and Pilot Plant Department, Engineering and Renewable Energy Research Institute, National Research Centre (NRC), Giza, Egypt.
[2]DG, SD & CE research Centre, ISWMAW, Former, Jadavpur University, India

**Corresponding Author: sheren51078@yahoo.com*

ABSTRACT: *Brick is one of the most important construction materials in any building since it is used for building of outer and inner walls of the building. The brick quality depends on the composition of production method, raw materials, firing temperature and method. Several trials have been done in order to maximize the utilization of unused wastes that harms the environment in manufacturing bricks which provide safe disposal to these wastes and also improve the properties of produced bricks. In this investigation addition of used engine oils (UEO), which were collected from the local maintenance centres in Egypt, instead of water as binder in bricks manufacturing, improved the properties of produced bricks such as increasing compressive strength, reduction of shrinkage and reducing the temperature required for firing the bricks. Using of (UEO) in bricks fabrication reduces harmful effect of waste disposal which causes huge environmental and health problems, in addition utilization of it in bricks production would be more beneficial since it is priceless raw material which decreases the cost of final product . (UEO) was used to replace part of water starting from 0% till 20%. Produced bricks were formed, dried and fired at different three temperatures (700°C, 750°C, and 800°C), for one-hour soaking time, and total firing time is 3 hours then these characteristics were determined: Drying shrinkage, green compressive strength, weight loss on firing, firing shrinkage, cold water absorption, boiling water absorption, saturation coefficient, apparent porosity, bulk density and compressive strength of fired samples. Addition of 10% (UEO) and firing at 700ºC produced clay bricks compatible with American standard ASTM C 62 / 2017. Obtained brick samples withstand a compressive strength more than 8.7 MPa, reducing firing temperature from 900ºC to 700ºC and finally decreasing the quantity of water used by 0.38 L / brick.*

Keywords*: Clay bricks; Waste oils; used engine oils; Waste recycling.*

Green Alternatives for Plant Containers: Developing Biodegradable Pots from Water Hyacinth, Coir, and Natural Fibers

Jessy K, Alwin James*, Ajo Sebastian, Pranav Prasad, SN Kumar, Nikki John Kannampilly

Amal Jyothi College of Engineering, Kottayam India

**Corresponding Author: appu123kumar@gmail.com*

ABSTRACT: *The demand for biodegradable and eco-friendly alternative pots to plastic is huge since plastic waste causes many environmental problems. This research work creates biodegradable pots made from a combination of water hyacinth, coir, and banana fiber as a natural fiber matrix with tapioca starch as the binding biopolymer matrix. There is the water hyacinth, an invasive aquatic flora, and banana fiber-which is an agricultural residue-and is highly abundant but underexploited material for sustainable development. Coir, besides being tough and having desirable water absorption characteristics, is mixed with the fibrous blends. The starch used as binder is tapioca, taking into consideration its biodegradability, availability in abundance, and excellent adhesive properties of the combination with natural fibers. The structural integrity and water retention capabilities of composite material are evaluated. Composite material is checked for compatibility with plant growth and degradability. Preliminary tests indicate that the products can be used as good media for plant growth and dissolve naturally without any toxic by-products. The production of such eco-friendly pots looks promising for an effective disposal of plastic in horticulture and agricultural and environmental waste recovery.*

Keywords*:*

From Waste to Value: Recycling, Energy Recovery, and Sustainable Manufacturing in Industry

P. Sobha Rani*, T. Geeta Madhuri

Department of Information Systems, GITAM school of business, GITAM Deemed to be University

**Corresponding Author: sponnada@gitam.edu*

ABSTRACT: *The shift towards a circular economy needs innovative technologies in waste treatment, recycling, co-processing, and sustainable manufacturing. The evolution of these areas makes it possible to perform recovery of energy and materials more productively, to produce and utilize the add-value products, and to use secondary raw materials. This approach not only reduces environmental impacts but is also consistent with Industry 4.0 and Industry 5.0 development models. Industry 4.0 allows for smart manufacturing and processes for recycling and co-processing by utilizing automation, interconnected systems, and real-time data. On the other hand, Industry 5 shifts the focus to humans while still being productive; the importance of environmental and social aspects comes first.The introduction of these technologies into the production process contributes to the efficient use of resources, minimization of waste, and a reduction in emissions. IoT and digital monitoring systems allow to improve audibility and accountability in waste management which in turn enables recovery of energy and materials from waste streams. Furthermore, Industry 5.0 sustainable manufacturing principles are those that integrate technology with people making sure that decisions are both ethical and environmentally friendly. Collectively, these technologies are virtual and physical.*

Keywords*: Circular Economy, Sustainable Manufacturing, Industry 4.0 & 5.0, Waste Management*

Sustainable Concrete Production: Assessing Cupola Slag as a Substitute for Fine Aggregates

Rakesh Sikder[1], Partha Halder[2], Rajarshi Chakraborty[3], Tanbir Islam[3], Sandeepan Saha[3]

[1]Dept. of Mechanical Engineering, Jadavpur University, Kolkata, India.
[2]Dept. of Mechanical Engineering, Government College of Engineering and Ceramic Technology, Kolkata, India
[3]Dept. of Mechanical Engineering, Greater Kolkata College of Engineering and Management, Kolkata, India

**Corresponding Author: rajarshi.chakraborty@gkcem.ac.in*

ABSTRACT: *The depletion of natural sand resources and the increasing demand for sustainable construction practices have led to explore alternative materials for use in construction applications. Cupola slag could partially replace natural sand in concrete production, contributing to waste reduction and resource conservation. The cupola slag as a viable alternative to natural sand in construction materials, highlighting the environmental and economic advantages it offers. Cupola slag is an industrial waste generated from cupola furnaces during cast iron production at temperatures ranging from 1400°C to 1600°C. For every 1 ton of cast iron produced, approximately 40 80 kg of slag is generated as a byproduct. The disposal of cupola slag is a matter of burden for the manufacturers of casting industry. Few researchers have used cupola slag as a coarse aggregate. The present study focuses on the replacement of cupola slag as a fine aggregate. This experimental study aims to reuse cupola slag in the construction industry, developing a novel way of solid waste management. In the M25 grade concrete, cupola slag is used as fine aggregate (FA), partially replaced by 0 50% (by weight) in the step of 10% (by weight). The 28 day results indicate that replacing natural fine aggregate with cupola slag by up to 40% enhances compressive and split tensile strengths compared to the control, affirming cupola slag's viability as a sustainable partial replacement in concrete.*

Keywords*: Cupola furnace slag, Fine aggregates, Green Concrete, Waste Management, Sustainable Development.*

Unlocking the Value from Beer Industry Waste: Food Additive from The Waste Streams

Anisha Kamble, Anuja Kulkarni *

School of Biotechnology and Bioinformatics, Padmashree D.Y. Patil Deemed to be University, Navi Mumbai

**Corresponding Author: anuja.kulkarni@dypatil.edu*

ABSTRACT: *Brewer's spent grain (BSG), a by-product of the brewing process, holds significant potential for value recovery in the food additive industry due to its high content of lignocellulosic material, protein, fiber, and bioactive compounds. This study explores BSG as a renewable source of protein hydrolysates, which can be utilized as functional food additives. The focus is on optimizing protein extraction through enzymatic hydrolysis, considering key factors such as enzyme type, temperature, and reaction time to maximize yield and nutritional quality. Successful enzymatic combinations have been identified, resulting in hydrolysates with improved amino acid profiles and high solubility. These protein hydrolysates exhibit functional properties such as emulsification and foam formation, making them suitable for incorporation into various food products. The research also investigates multiple waste pre-treatment methods, followed by assessments of Total Phenolic Content (TPC), Total Flavonoid Content (TFC), and DPPH radical scavenging activity. Prebiotic properties were evaluated alongside protein extraction using both alkaline and ethanol-based methods, followed by hydrolysis. The resulting protein hydrolysates were then formulated into a food additive and applied to cookie development, where their techno-functional properties were analyzed. This research contributes to the circular economy and sustainable practices by transforming waste into food additives. The findings underscore BSG's potential as a valuable protein source and pave the way for future food technology innovations aimed at enhancing food security and reducing environmental impact.*

Keywords*: Beer Spent Grain, Protein Hydrolysates, food additives, nutraceuticals*

Utilization of Guava Waste (Some Potential Beneficial Aspects)- A review

Anis Mirza, Vikanksha, Arun Kumar, Jatinder Singh*

Department of Horticulture, School of Agriculture Lovely Professional University, Phagwar, Punjab, India

**Corresponding Author: author-jatinder.19305@lpu.co.in*

ABSTRACT: *Potentially, serious economical and nutritional losses aspects occur in fruits, both fresh as well as in processing industries. Approximately, 25% to 30% of waste material is supposed to be produced during processing activities. Such material mainly comprises seeds, surface and pomace. During intercultural practices lod of leaves, bark and twigs, removed/fell. All these plant parts are considered waste material, contain a lot of potentially valued bioactive compounds, can be used for the extraction of dietary fibres, polyphenols, carotenoids, enzymes, oils and vitamins etc. These bioactive compounds can be efficiently used in the food industry for the advancement of new, innovative and enriched besides healthy foods, to be used in medicines and pharmaceuticals industry, textile industry and others. Towards sustainable development, the most important aspect is recycling of sources including resultand waste material. This review article describes different types of waste material (declared) that originates during guava cultivation/processing, can be utilized as a potential source of valuable binactive components These wastes materials have a lot of good quantity, quality phytochemicals and high potential antioxidants. In this activity economics and utilization of waste from guava orchard, is a prime point of consideration. This approach will also help to minimize the pollution-related problem.*

Keywords*: Guava waste, Intercultural operations, Processing, Bioactive compounds, Technology*

Development of liquid fertilizers from dairy waste and its effect on soil properties

Prity Mehta, Sanjay Yadav*

Department of Agriculture Science, Faculty of Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh, India

**Corresponding Author: sanjayyadav@dei.ac.in*

ABSTRACT: *Purpose*
Dairy industry generates huge amount of waste and by-products during processing and production of milk and milk products, which can be re-utilized for resource optimization, recycling and ecological sustainability of the dairy industry. Hence, the current study explores the potential of converting dairy waste into eco-friendly liquid fertilizers through the biotransformation capabilities of Pseudomonas aeruginosa and Enterobacter aerogenes. The nutrient-rich fertilizers not only enhance the soil health but also supports waste to wealth approach and contributes to circular economy.
Material and Methods
Fertilizer from dairy waste water was developed by 4 different methods (1) inoculated with Pseudomonas aeruginosa, (2) Enterobacter aerogenes (3) consortium and (4) no-inoculum. The physico-chemical and heavy metal analysis of developed liquid fertilizers were evaluated and later on applied to soil (@1% of weight of the soil) at every 15 days up to 90 days.
Results
The result shows that the soil properties were enhanced by the application of all 4 different types of liquid fertilizers. However, best results were shown by (method 3) consortia of Pseudomonas aeruginosa and Enterobacter aerogenes (1:1) which majorly enhanced the P2O5 and K2O content of soil from 2.5 kg/h and 44.6 kg/h to 177.3kg/h and 322.6 kg/h. The liquid fertilizer formulated by consortia showed better results in which N, P, K, Ca, Fe, Cu, Mg, and Zn contents were 40.0, 107.10, 44.79, 10.10, 0.03, 0.27 and 0.93 ppm respectively. ICP-MS analysis shows heavy metals of liquid fertilizers were within the applicable standards.

Keywords*: Dairy waste, liquid fertilizer, soil properties.*

Transforming Waste into Resources A Comprehensive Analysis Of Global Solid Waste Management

B Anjaneyulu*

Vignan's Institute of Information Technology

**Corresponding Author: anjaneyulub.mec@srit.ac.in*

ABSTRACT: *Solid Waste Management (SWM) has become an increasingly urgent challenge for governments, urban planners and policymakers worldwide due to rapid population growth, urbanization and rising industrial activities. As the volume of waste escalates the need for effective SWM is paramount to mitigate environmental degradation, promote resource efficiency and achieve the United Nations Sustainable Development Goals (SDGs). This paper provides an in-depth analysis of global trends in waste generation and management identifying key challenges faced by low middle- and high-income countries. It explores innovative solutions such as waste to energy technologies, recycling and the adoption of circular economy principles that can help transform waste into valuable resources. Additionally, the study highlights successful international SWM practices focusing on countries that have pioneered advanced systems for waste reduction and resource recovery. Policy recommendations are offered to encourage global scaling of sustainable waste management practices, aiming for a transition towards more resilient and eco-friendly systems..*

Keywords*:*

Sustainable Concrete: Evaluating the Strength of M25 and M30 Grades with Partial Cement Replacement Using SCBA, GGBS, and Granite Powder

Borigarla Barhmaiah, Mantha Venkata Sowmya*, Padmakar Maddala, Karri Srinivas
Dept. of Civil Engineering, Vignan's Institute of Information Technology (A), Visakhapatnam, India
**Corresponding Author: manthasowmya100@gmail.com*

ABSTRACT: *This research investigates the potential of partially replacing cement with Sugarcane Bagasse Ash (SCBA), Ground Granulated Blast Furnace Slag (GGBS), and Granite Powder (GP) in M25 and M30 grade concrete, aiming to reduce reliance on Ordinary Portland Cement (OPC) and lower carbon emissions associated with concrete production. Each of these materials is a by-product from industries with environmental concerns: SCBA from sugar mills, GGBS from steel production, and GP from granite processing. By optimizing their usage in concrete, this study contributes to sustainable waste management and eco-friendly concrete. Concrete samples were prepared with varying replacement ratios of SCBA, GGBS, and GP. The results demonstrate significant improvements in mechanical properties at optimal replacement levels of 10% SCBA, 50% GGBS, and 10% GP. For M25 and M30 grades, this combination enhanced compressive strength, with peak 28-day values reaching 31.15 N/mm² and 35.76 N/mm², respectively, under water curing. Tensile strength also improved, reaching maximum values of 4.31 N/mm² and 5.45 N/mm² for M25 and M30 grades, outperforming conventional mixes. Statistical regression models developed for compressive and tensile strength yield high accuracy, with R^2 values of 0.92 and 0.89, confirming the consistency of results. The findings establish that replacing OPC with SCBA, GGBS, and GP not only improves concrete strength and durability but also provides a sustainable approach to waste management. Utilizing these industrial by-products in construction promotes resource conservation, reducing environmental impacts and advancing sustainable development practices in the construction sector. Future research should focus on the long-term durability of these mixes in diverse environmental conditions to further solidify their applicability in mainstream construction. Further, regression analysis was employed to predict the compressive and tensile strengths of M20 and M30 grade concrete using partial replacement materials. The performance of the models was evaluated using key metrics such as R-squared, Mean Absolute Error (MAE), and Root Mean Square Error (RMSE). R-squared values demonstrated that the models accounted for a significant portion of the variability in the compressive and tensile strengths, indicating a high degree of fit. MAE and RMSE values were used to assess the predictive accuracy, with lower values suggesting that the models provided reliable strength predictions.*

Keywords*: Sustainable Concrete, Compressive tensile strength, Partial Replacement, Regression Analysis.*

The practice of using waste and secondary resources in road construction in Russia. Challenges and prospects

Vladimir Maryev*
Russian Federation, Federal R&D Institute for Road Construction, Russia
**Corresponding Author: vmaryev@yandex.ru*

ABSTRACT: *The Government of the Russian Federation has compiled a complete list of documents (Orders and Regulation Acts) that contain requirements for the use of secondary resources in construction, including road construction, but the requirements have rather weak prospects for successful systemic implementation without an enforcement algorithm and in the absence of support measures. The use of secondary resources is an important reserve for resource conservation in the construction and repair of highways and increasing the efficiency of spending material, energy and financial resources in the road industry. The development of transport infrastructure in the Russian Federation, namely the construction of highways and artificial structures, requires more and more natural resources every year, but the natural resources are depleted every year. The use of secondary resources - large-tonnage waste from mining industries, coal generation companies, metallurgical enterprises and other types of production, is the path to resource efficiency. It is the basic principle of the economic policy of the Russian Government aimed to the development of the Circular economy and sustainable development principles at present. In the implementation of the Government's industry programs for the use of secondary resources in construction, the following factors were noted as the block factors for the secondary resources usage in the road construction projects: • Measures to support and stimulate waste recycling and their involvement in construction have not been taken;• Lack of interest from industry enterprises in the use of secondary resources in the road construction projects;• Technological limitations;• Shortage of qualified personnel;• Lack of systematic collection of data on the collection, processing and involvement of construction waste;• Low tariffs for waste disposal;• Availability of natural resources. These are the main problems to be resolved within the framework of the National Project "Circular Economy".*

Keywords*:*

Resource Recycling from Sewage Sludge using Sewage pelletized technology (J-Combi system)

Kohta Nozaki*, Yuichi Murata, Nobuhiro Tanigaki
Nippon Steel Engineering Co., Ltd
**Corresponding Author: nozaki.kohta.3he@eng.nipponsteel.com*

ABSTRACT: *As the world increasingly focuses on achieving carbon neutrality and adopting circular economy practices, it is crucial to reduce reliance on fossil fuels and integrate renewable resources into energy systems. One of the most abundant yet underutilized resources is sewage sludge, which, despite its high organic content—including valuable elements like phosphorus, nitrogen, and energy—is primarily incinerated in current waste management practices. This approach overlooks the potential of sewage sludge as a sustainable source of energy and fertilizer. In Japan, the Ministry of Land, Infrastructure, Transport, and Tourism has been actively promoting initiatives to convert sewage sludge into solid fuel, thus advancing both energy creation and conservation goals. In alignment with this, Nippon Steel Engineering Co., Ltd. has constructed eight J-Combi projects, focusing on converting sewage sludge into solid fuel and, notably, fertilizer. These projects not only contribute to the reduction of greenhouse gas emissions but also support global sustainability objectives by repurposing waste into valuable resources. This presentation will explore the technological advancements, environmental benefits, and contributions of the J-Combi technology to achieving a more sustainable and circular economy.*

Keywords*:*

Development and Characterization of Flax-Sisal Hybrid Natural Fiber Composites: A Sustainable Approach to Enhanced Mechanical Performance

Satish Geeri[1,*], Chitturi Ram Prasad[2], Jithendra Sai Raja Chada[3]

[1]Department of Mechanical Engineering, Vignan's Institute of Information Technology(A), Duvvada, Visakhapatnam, Andhra Pradesh, India
[2]Department of Mechanical Engineering, Aditya University, Surampalem, Andhra Pradesh, India
[3]Quality Control department, Core Carbide Tools, Hyderabad, Telangana, India

**Corresponding Author: geerisatish@gmail.com*

ABSTRACT: *Fiber-reinforced composites dominate many applications due to their specific strength and modulus; Natural fibers derived from plant extracts are gradually replacing the use of artificial or synthetic fibers as reinforcement. A feature of natural fibers is the capriciousness of their properties. In this experiment, it is expected to obtain the properties of the samples prepared by using sisal and flax fibers in epoxy glass. Initially, 3 samples were prepared from 40% sisal, 40% linen and 40% sisal and linen mixture. Designs were developed using tensile testing, Izod impact testing and three-point bending. Mechanical test results and SEM micrographs show that sisal and flax hybrid fibers can be used as good electrical materials in the use of composite materials. Research shows that the composite material composed of sisal and flax has excellent tensile strength, flexural strength and hardness of 219.5MPa, 357.26MPa and 85BHN respectively, which makes it useful for low energy use such as car interior, body Engineering. and higher makes it useful for soil.*

Keywords*: Hybrid Natural Composites, Flexural Strength, Sisal and Flax Fibers, Tensile Strength*

Characterization of Mechanical Properties in Epoxy Composites with Natural Fiber Reinforcement and Coconut Shell Ash Additives

G. Rama Krishna*, P.M.M.S. Sarma, M Sreenivasa Rao, Dr. E. Nirmala Devi, P.V.V. S. Maneendra

Godavari Global University, Rajahmundry, A.P, India

**Corresponding Author: ggkrishna999@giet.ac.in1*

ABSTRACT: *Natural fiber-reinforced composites have attracted considerable interest as sustainable alternatives to synthetic fiber composites due to their renewable, biodegradable, and environmentally friendly characteristics. This study focuses on the preparation and evaluation of epoxy composites reinforced with banana and pineapple fibers, incorporating varying amounts of coconut shell ash as a filler. The composites were fabricated using the hand lay-up technique, with coconut shell ash content ranging from 0% to 5% by weight. Mechanical properties, including tensile strength, flexural strength, and impact strength, were assessed to determine the performance of the composites. The results indicate that the inclusion of coconut shell ash significantly influences the mechanical properties, showcasing the potential of these natural fiber composites for various applications in eco-friendly materials.*

Keywords*: Coconut Shell Ash, Banana Fiber, Pine apple fiber, Mechanical Properties*

Response Surface Optimization of Cold Extrusion Process Factors on 6061 Aluminium Alloy Metal Matrix Composites Reinforced with Nano SiC Particles with 2 Response variables and 3 Control factors

Rajesh Kumar Pedada*, Vijay Kumar Ambatti, Srinivas Rokkala,c Karun Kumar Yandava

Raghu Engineering College, Visakhapatnam, India

**Corresponding Author: rajeshpedada346@gmail.com*

ABSTRACT: *is need of the hour. The current paper is devoted to the experimental investigation of the effect of cold extruder geometric and process parameters on mechanical properties, as well as the optimization of the above factors using response surface methodology for minimum extrusion force and maximum hardness. The DOE with full factorial design was used for the experiment, which had 27 trial runs. The effect of changing control parameters such as ram speed, die angle, and %SiC on extrusion force and hardness was investigated. Response surface models were created with experimental data using Design-Expert Version 6.0.8. The optimum die angle, ram speed, and %SiC levels are obtained as 20°, 2.01mm/min, and 0.1 for an optimal response surface of minimum Extrusion force (187.3 kN) and maximum Rockwell hardness (114.77).*

Keywords*: Response surface optimization, Extrusion parameters, Mechanical properties, Full factorial design.*

XXII.
Water and Waste Water

Water Pollution its Causes and Effects in Present Scenario

P. Sridhar*
Department of Accounting Finance, GITAM School of Business Hyderabad. GITAM (Deemed to be University), Hyderabad Campus. Rudraram, Telangana State, India
**Corresponding Author: spinnint3@gitam.edu*

ABSTRACT: *The study of water contamination is one of the important subjects that has drawn the interest of environmentalists and scholars due to its profound impact on the lives of people, animals, and plants. It is more closely related to soil and air contamination than it is less dangerous. The study of pollution in general and water pollution and its causes were the main foci of the research. There have been several pollution processes in addition to groundwater contamination, the most significant of which include biological, physical, and the disposal of solid and liquid waste into rivers, lakes, and oceans.*

Keywords*: Factories, Air, Water; Seas, Environment, Germs.*

Isolation and Screening of Chlorpyrifos Degrading Microorganisms from the Contaminated Agriculture Soil

Karthika G, S. Velvizhi*
Department of Biochemistry, Biotechnology and Bioinformatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India
**Corresponding Author: Velvizhi_bc@avinuty.ac.in*

ABSTRACT: *Soil microbes ensure the effective and eco-friendly measure to remove the chemicals from soil. Our study aimed to investigate that the naturally occuring microflora involved in the biodegradation of pesticide contaminated soil. Chlorpyrifos (Cp), is one of the major orgnophosphate pesticide extensively used in agriculture sector. Microorganisms break down organophosphates is by utilising them as sources of carbon, nitrogen, or phosphorus. Soil samples were collected with an extensive history of the usage of CP from the agricultural area of the Coimbatore District, Tamilnadu. Enrichment culture method was used to isolate the bacterial strains and most potent three strains were used for identification and degradation studies. Three strains such as Pseudomonas aeruginosa, Psuedomonas otitidis and uncultured proteobaterium were identified using 16srRNA sequencing method. The GC-MS analysis proved that CP converted in to 2, 5- dihydroxy pyridine, Benzene 1, 3-bis (1,1- dimethylethyl) and 4- pyridinol, 2,3,5- trichloro by Pseudomonas aeruginosa Psuedomonas otitidis and uncultured proteobaterium respectively. Our study concluded that the three strains isolated from the contaminated agriculture soil samples shows the ability to degrade the CP along with plant growth promoting activites.*

Keywords*: Bioremediation ,Chlorpyrifos, organophosphate, Psuedomonas otitidis, Pseudomonas aeruginosa.*

Water Quality Assessment of Mahendratanaya River using Statistical Techniques and Water Quality Index

CH.V. Sai Krishna, L. Vaikunta Rao*
Department of chemistry, GITAM University, Visakhapatnam, India
**Corresponding Author: saisrikar.ch@gmail.com*

ABSTRACT: *Water is an essential resource for all living species. Monitoring the quality of surface water is crucial for providing sustainability in agricultural regions and provides vital data for the management of irrigation water. The objective of the study is to emphasize the quality of Mahendratanaya river water in terms of water quality index, heavy metal pollution index, and irrigation water quality parameters. Multivariate statistical methods such as pca and cluster analysis were used to establish the source of contamination. According to wqi values, all sampling stations are found with good quality in both interventions, and water quality varies significantly geographically and temporally, with a general trend of improvement following the monsoon. The HPI is below the critical value, traces of Cd+2 are found, mercury is absent in the Mahendratanaya river, and other metals are within acceptable levels. Piper diagrams are used to show how the chemistry of water changes. Pre-monsoon water is Ca-HCO3 type owing to carbonate-rock interaction, while post-monsoon water is mixed water type due to ion concentration shift through dilution. The dendrograms were used to classify the sampling sites into different clusters based on their similarities. The three principal components for two seasons were found to explain 91.8% of the overall change in the preseason and 93.4% in the postseason. The variables in both seasons are mostly hydrochemical in nature and have been suggested to be an outcome of geological processes, implying geogenic origins. A potential magnesium hazard has been found in certain locations in post-monsoon, and the water quality is suitable for irrigation, with modest changes depending on location and season. This work adds to our understanding of how seasonal fluctuations affect water quality, providing essential information for policymakers and stakeholders.*

Keywords*: Irrigation parameters, Wqi, Heavy metals, statistical techniques, magnesium hazard, seasons.*

Production and Characterization of Biofuel from Diary Milkscum Waste

Abhilash Onkarappa*
India
**Corresponding Author: abhilash-me@dsu.edu.in*

ABSTRACT: *The use of diesel fuel has experienced a sharp increase in recent years. The transportation sector accounts for over 70% of all petroleum consumption. Bio-fuel generation has attracted considerable attention in recent years as a possible answer to the growing energy demand and the necessity to lower carbon emissions. An area of focus in bio-fuel production is the use of dairy milk scum waste, a by-product of dairy processing, as a raw material for bio-fuel synthesis. Dairy milk scum waste is a mixture of blend of proteins, fats, and carbohydrates that forms during the processing of milk. It is usually separated from the milk and disposed of as waste. This indicates that there is a readily available and plentiful supply of milk scum, which can serve as a feed-stock for bio-fuel generation. Milk scum contains a high lipid content, making it an appealing feed stock for bio-diesel synthesis. Lipids are transformed into bio-diesel through trans esterification, a chemical process that is well-known and fairly straightforward. The primary aim of this investigation is to lower the cost of bio-diesel by using dairy milk scum waste. In present investigation dairy milk-scum waste is used for production of bio-fuel by basic transestrification process using potassium hydroxide as catalyst and after the production of bio diesel separation of bio fuel from foreign particles and finally characterization of the bio-fuel extracted from dairy milk-scum waste is compared with standard diesel.*

Keywords*:*

Self- Rejuvenation Capacity of a River - A Case Study

Abhijith*
India
**Corresponding Author: abhijith-cvl@dsu.edu.in*

ABSTRACT: *Rivers play a crucial role in sustaining the livelihoods of people, yet their water quality is often compromised by pollutants entering through various sources. This study explores the natural self-purification process of the Kaveri River and its tributaries, focusing on how the river's water quality is affected by and recovers from pollution. Natural self-purification involves the decomposition of organic materials by fungi, bacteria, and other microorganisms, which helps restore water quality despite initial contamination near pollution sources.To understand this phenomenon, the research involved collecting water samples from multiple locations along the Kaveri River and its tributaries. These samples were analysed for both physical and chemical parameters at various points along the river's course. The analysis aimed to track the changes in water quality from the pollution entry points to downstream areas, assessing the river's capacity to rejuvenate itself.The study findings highlight that while water quality can deteriorate near pollutant entry points, the river exhibits a significant ability to self-recover over distance. This natural rejuvenation process underscores the effectiveness of the river's ecological mechanisms in mitigating the impacts of pollution. By examining the physical and chemical characteristics of the river water at different stages, the research provides insights into the river's self-purification capabilities and contributes to a better understanding of how natural systems can manage and recover from pollution.*

Keywords*: Recycling*

Assessing the Efficiency of Carbon-Doped TiO_2 for Wastewater Disinfection: A Study of Photocatalytic Inactivation of Escherichia Coli

Ashish Arvind Arbale*, Nilambari Ashish Arbale
Department of Environmental Science, Savitribai Phule Pune University, Pune, Maharashtra, India
**Corresponding Author: ashish.arbale@gmail.com*

ABSTRACT: *The increasing concern over traditional wastewater disinfection methods such as chlorination and ozonation stems from the formation of harmful disinfection by-products (DBPs) like trihalomethanes and haloacetic acids, which are associated with carcinogenic risks. This research investigates an alternative disinfection approach using photocatalysis with titanium dioxide (TiO_2) doped with carbon. The objective was to assess the efficiency of photocatalytic inactivation of Escherichia coli bacteria in synthetic wastewater under UV and visible light conditions. Experiments were conducted in a custom-built quartz reactor, where bacterial cultures were exposed to UV and visible light sources. The doped TiO_2 was tested against standard TiO_2 to determine the best performance for bacterial inactivation. Results showed that the carbon-doped TiO_2 under UV light achieved significant bacterial reduction, with higher inactivation rates compared to visible light or non-doped TiO_2. These findings demonstrate the potential of doped TiO_2 photocatalysis as an effective, environmentally friendly alternative to traditional water disinfection methods, offering a cost-effective solution without harmful by-products.*

Keywords*: Sustainability, Nano-particles, TiO_2, Water Treatment, Disinfection.*

Wastewater Treatment and Reuse: A Review of its Applications and Health Implications using AI

K. Phalguna Rao*, Krishna Prasad K
Srinivasa University, Mangalore, India
**Corresponding Author:* kprao21@gmail.com

ABSTRACT: *Water scarcity is one of the major problems in the world and millions of people have no access to freshwater. Untreated wastewater is widely used for agriculture in many countries. This is one of the world-leading serious environmental and public health concerns. Instead of using untreated wastewater, treated wastewater has been found more applicable and eco-friendly option. Moreover, environmental toxicity due to solid waste exposures is also one of the leading health concerns. Therefore, intending to combat the problems associated with the use of untreated wastewater, we propose in this review a multidisciplinary approach to handle wastewater as a potential resource for use in agriculture. We propose a model showing the efficient methods for wastewater treatment and the utilization of solid wastes in fertilizers. The study also points out the associated health concern for farmers, who are working in wastewater-irrigated fields along with the harmful effects of untreated wastewater. The consumption of crop irrigated by wastewater has leading health implications also discussed in this review paper. This review further reveals that our current understanding of the wastewater treatment and use in agriculture with addressing advancements in treatment methods has great future possibilities.*

Keywords*: Bio-computation, Biomass, Diseases, Environmental pollution, Human health, Sustainable agriculture, Wastewater.*

Environmental Impact Assessment of Effluent Treatment Plant's Sludge from Pharmaceutical Industries for Ensuring Safe Disposal in Secure Landfills

Chinnarao Menda[1,*], Ch. Ramakrishna[2], R. Uma Devi[2], V D N Kumar Abbaraju[2]
[1]EHS, Raks Pharma Private Limited, India
[2]GITAM University, Visakhapatnam, Andhra Pradesh, India
**Corresponding Author: cmenda@gitam.in*

ABSTRACT: *This present work reveals the effluent treatment plant (ETP) that processes pharmaceutical waste, a significant source of pollution impacting the physicochemical parameters of terrestrial and aquatic ecosystems. Untreated or inadequately treated effluents pose a severe threat to environmental health. This article analyzed effluent samples collected from 15 locations across Visakhapatnam and Srikakulam between February 2022 and April 2023. The physicochemical parameters were evaluated to assess their compliance with secure landfill disposal standards. Most samples exhibited stable behaviour, with no violent chemical reactions in the presence of air or water, and no explosion risks under normal conditions. The pH levels of the samples ranged from 4.12 to 10.91. The bulk density values varied between 0.86 g/cc and 1.46 g/cc. The loss on drying at 105°C was between 6.35% and 85.03%, while the loss on drying at 550°C, which indicates the presence of degradable or non-degradable content, ranged from 22.65% to 98.12%. Calorific values were generally below 2500 Cal/gm. The levels of extractable and water-soluble in organics were found to be within the acceptable limits, with water-soluble organics being under 10% in all samples. Heavy metals are measured in the samples. Cadmium is detected up to 9.36 mg/Kg, which is above the standard limit of 0.1 mg/Kg. For the disposal of these samples in a secure landfill, specific treatment methods were applied to stabilize the waste. Some samples were directly disposed of in landfills, while others were treated with various combinations of fly ash, lime, cement, or incinerated. Other samples were treated with fly ash, ranging from 50% to 200%, and lime before being disposed of in a secure landfill. This comprehensive analysis highlights the critical importance of appropriate treatment methods to ensure that sludge from pharmaceutical industries is disposed of safely, minimizing the environmental impact and adhering to regulatory standards.*

Keywords*: ETP, EIA, Pharmaceutical waste, physicochemical properties, heavy metals, secure landfill disposal.*

Combating Air Pollution with Hydroponics, Water Treatment, and Smart Sensors

Shreeya*, Ch R Phani Kumar
GITAM School of Technology, India
**Corresponding Author: rchintal2@gitam.edu*

ABSTRACT: *Air pollution in urban areas, caused by particulate matter (PM), nitrogen oxides (NOx), and volatile organic compounds (VOCs), poses significant health and environmental risks. The Hydro Harvest project presents a sustainable solution by combining hydroponic systems, water treatment, and smart sensor technology to create green spaces that purify the air and conserve water. Using hydroponics, plants absorb pollutants while releasing oxygen, improving urban air quality. A water treatment plant recycles grey water and rainwater, providing clean, nutrient-rich water to the system. Smart sensors monitor environmental conditions, nutrient levels, and water quality, automating adjustments to ensure optimal plant growth and resource efficiency. The system reduces human intervention and promotes scalability, with significant savings in water and maintenance costs. Challenges such as initial investment and sensor malfunctions are addressed through calibration and backup systems. Hydro Harvest offers a viable model for improving air quality, reducing water waste, and fostering sustainable urban agriculture.*

Keywords*: Hydroponics, air pollution, urban sustainability, water treatment, sensor technology, green spaces, smart systems, resource efficiency, sustainable agriculture.*

The Effect of pH on Nitrification Efficiency in Recirculating Aquaculture Systems: Insights into Ammonia and Nitrite Oxidation

Mohita Chugh[1], Rina Chakrabarti[2], Jai Gopal Sharma[1,*]
[1]Department of Biotechnology, Delhi Technological University, India
[2]Department of Zoology, University of Delhi, India
**Corresponding Author:*

ABSTRACT: *The adverse effects of wastewater on environment raise a strong interest for development of sustainable technologies and their optimization. Recently, scientists are shifting towards eco-friendly approach where water has been recycled for the culturing of fishes. For the reutilization of water, nitrification plays a major role in recirculating aquaculture system (RAS). To increase the efficacy of RAS, optimization of pH has been studied in three different experiments at different pH, experiment 1 (5, 6, 7, 8 and 9); experiment 2 (6, 7, 8 and 9) and experiment 3 (7, 7.5, 8, and 8.5). The clay pebbles consist of microorganisms was taken from the bio-filtration unit of RAS and were distributed similarly in the experiments. The ammonia and nitrite reduction and nitrate production were observed regularly after 1 day. Maximum ammonia reduction was found at pH 6 in the temperature range of 20 - 25 °C and pH 7 in the range of 26 - 27°C. The maximum nitrate production was found below or at pH 7.0 at 20-27°C. The extreme pH towards acidic and basic sides affects the efficacy of the bio-filtration unit.*

Keywords*: Nitrification, pH optimization, Recirculating Aquaculture System, Wastewater.*

Sustained Effluent Management Practices: An Approach to Circularize Unit Operations in Dairy Industry

Sushma Gautam*, Nandini Bansal, Deepal Sharma, Daksh Massey, Nikhil Dogra, Neha Sharma

Department of Bio-Sciences and Technology, Maharishi Markandeshwar Engineering College, Maharishi Markandeshwar (Deemed to be University), Ambala (Haryana), India

**Corresponding Author: sushmagautam3255@gmail.com*

ABSTRACT: *Globally, dairy sector witnesses a significant challenge culminating from lack of stringent effluent management practices; contributing to eco-toxicological manifestations including climate change, eutrophication, acidification, threat to biodiversity and health adversities. Attributed to enriched organic matter and excessive nitrogen, phosphorus and other trace elements; improvised effluent management approaches including anaerobic digestion and repurposing as prospective matrix have been devised as an alternative to conventional management of effluent. As a value proposition model in order to generate a paradigm shift, an array of applications including resource recovery, resource mobility and utilization are considered as sustainable solutions. This strategy may be practically implemented for pollution abatement, soil replenishment and bioenergy. Circular Economy (CE) is an evident solution for. The Linear Economy (LE) model of take-make-use-dispose, needs to be substituted by CE model that includes; utilization of a resource to the maximum and using waste as secondary raw material as a value proposition model. Complacency in recycling, re-use, reduce policy has increased both demand and supply of depleting resources, thus necessitating strict implementation of CE. Dwindling resources and subsequent generation of enormous volumes of waste water has urged CE interventions. This lucid account corroborates the fact that WWTPs with an operational circular model with energy production and resource recovery should be channelized as a component of policy interface. This would necessarily help us inch closer to attainment of Sustainable Development Goals (2&3).*

Keywords*: Circular Economy, Dairy industry, Effluent Management, Resource mobilization, Sustainable Development Goals (SDGs).*

Hydrogel Strategies for Improving Growth and Yield of Spinach (Spinacia oleracea L)

M.N. Jayasudha*, M. Kiranmai Reddy

Department of Life Science (Environmental Wing), GITAM School of Sciences, GITAM (Deemed to be university), Vishakhapatnam, A.P, India

**Corresponding Author: nmaddile@gitam.in*

ABSTRACT: *This study assesses the impact of hydrogel and phosphate-solubilizing bacteria (PSB), both individually and in combination, on soil physicochemical and biological properties and the yield of Spinacia oleracea L. under drought conditions. Five treatments were applied: Control, DAP, DAP + Hydrogel, PSB, and PSB + Hydrogel. Soil properties such as physicochemical parameters, organic matter content, and biological activity were evaluated both before and after harvest. Among the treatments, the combination of PSB + Hydrogel showed the most significant improvements in soil properties. This treatment enhanced soil physicochemical and biological attributes, such as increased organic matter and microbial activity, leading to healthier soil. Moreover, the PSB + Hydrogel treatment resulted in a notable increase in spinach yield compared to other treatments. These findings highlight the interactive potential of hydrogel and PSB as biofertilizers, especially under drought-stress conditions. The combined application of these treatments improved soil health and encouraged crop productivity. This approach offers a promising strategy for enhancing agricultural sustainability, particularly in regions facing water scarcity.*

Keywords*: Hydrogel, PSB, Sustainable Agriculture.*

Conventional Solar Still for Water Purification

Shailendra Kumar Shukla*
Centre for Energy and Resources Development, Mechanical Engineering Department, Indian Institute of Technology (BHU), Varanasi, India
**Corresponding Author: skshukla.mec@iitbhu.ac.in*

ABSTRACT: *This study investigated the theoretical analysis of the simple single slope solar still using MATLAB Code. Experiment was performed in the Varanasi region (25°19'3.52"N, 82°58'26.09"E) on the roof of CERD Lab IIT (BHU). In this study, we used single slope solar still with base area 1m2, and brackish water source which maintain the water depth up to 2cm in the basin. Consequently, we observed that increase in velocity of air and increase in area of basin results increase in mass of water evaporated. It is inferred that theoretical distilled water we get is greater than the experimental value due to experimental uncertainty.*

Keywords*: Desalination, Distillation, Cumulative mass, Evaporation, Output.*

Nitrate Removal from Synthetic Aqueous Solution and Drinking Water using Aqueous Extract of Citrus Aurantifolia

Jeyadevi Kadarkarai[1], Selvakumar Muniraj[2], Santhiya Mahalingam[3], Vasanthy Muthunarayanan[1,*], Ponnadurai Ramasami[4]
[1]Department of Environmental Biotechnology, School of Environmental Sciences, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India
[2]Aadhi Boomi Mining and Enviro Tech (P) Ltd., K.S.V. Nagarr, Narasothipatti, Tamil Nadu, India
[3]Department of Chemistry, Faculty of Science, University of Mauritius, Réduit, Mauritius
[4]Department of Chemistry, University of South Africa, Private Bag X6, Florida, South Africa
**Corresponding Author: vasanthy@bdu.ac.in*

ABSTRACT: *Water is a resource and its characterization becomes essential forever. With the urbanization and Population explosion, over extraction of drinking water /ground water has happened, which has affected the water quality. Hence understanding the hydro-geochemical processes in both surface and ground water resources becomes mandatory, as it directly influences the concentration of the organic and inorganic elements in water. With this as the background of this study, water quality analysis of different areas of Pudukkottai district was done. Of the various ions present in the water, focus is made on the nitrate ions in the present study. Researchers have reported the incidence of Methemoglobinemia due to the consumption of drinking water contaminated with higher levels of Nitrate-N. Hence the aim of the present study was to collect drinking water samples from different taluks of Pudukkottai district and to analyse the nitrate –N content of the same. Further, the study involves the utilization of the powdered Citrus aurantifolia leaves for the Nitrate-N reduction from the synthetic nitrate N solutions and drinking water samples. From the synthetic NO3-N solution of 30 ppm, a reduction of about 96% was achieved. The reduction of nitrates was attributed to the plant based anti-oxidants.*

Keywords*: Nitrate reduction, Citrus aurantifolia, Piper diagram, anti-oxidants, inorganic elements.*

Vetiveria Zizanioides (L.) Plant as Green Non-toxic Adsorbent for Iron Removal from Aqueous and Drinking Water

B. Sowmiya Rajalakshmi[1], M. Vasanthy[2], C. Thamarai Selvi[1,*]

[1]Department of Biotechnology, Mother Teresa Women's University, Kodaikanal, Tamil Nadu, India
[2]Department of Environmental Biotechnology, Bharathidasan University, Trichy, Tamil Nadu, India

**Corresponding Author: vasanthy@bdu.ac.in*

ABSTRACT: *The aim of the present study is to assess the suitability of Vetiveria zizanioides (L.) root for iron removal from potable water. The effect of three parameters including pH, time and adsorbent dosage on the iron removal were studied in iron aqueous solution. About 15 potable water samples in and around Kodaikanal were collected from tribal and non-tribal areas and water quality was assessed. The exceeding amount of iron among 5 water samples was found when compared with BIS standard for drinking water and subjected to iron removal process with adsorbent root powder. And it's removed about 70% of iron from aqueous fluoride solution (2ppm) by 2 hr treatment time, at 6.6 pH with 0.15g of adsorbent dose treatment. Potable water defluoridation also showed 75% of iron reduction with 0.15g of adsorbent dose treatment. Root powder characterized of biochemical, proximate, antimicrobial activity and GC-MS. The purpose of this research was to discover the components present in natural plant-based biocoagulants. By contrasting the fragmentation features of the isolates' mass spectra and retention indices to library sources from NIST, WILEY, and PESTE, which were utilized to match the identified components from the plant material, the components in the aqueous and methanol extracts were identified. The results revealed the existence of a variety of phytochemical components such as oleic acid, hexadecanoic acid, oxatetracyclododecane, ascorbic acid and octadecadienoic acid. These phytochemicals have antioxidant, antibacterial, antifungal and larvicidal activities, among other biological capabilities. This study suggests, the phytoadsorbent root powder is capable to remove iron effectively from drinking water samples due to the presence of its metal phytochemical components.*

Keywords*: Vetiveria zizanioides (L.), iron, phytochemical analysis, antimicrobial activity, GCMS.*

Smart Cities and Wastewater Treatment: Bridging Circular Economy and Sustainable Development Goals (SDGs)

N. Sharma*, G Tiwari, P. Paswan, S. Gautam

Department of Bio-Sciences and Technology, Maharishi Markandeshwar Engineering College, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala (Haryana), India

**Corresponding Author: nehamicrobiologist@gmail.com*

ABSTRACT: *A significant exponential growth in urban clusters has been noted in the recent past, which continues to persist. consequently, there is an inadvertent exertion of, geo-political, socio-cultural, socio-economic and environmental pressures. Among the prime issue is the generation, is waste, accumulation and mobilization of waste, which necessitates immediate and time -sensitive intervention. In the context of sustainable development, the incorporation of the Circular Economy (CE) is regarded as one of the main objectives of modern societies. The main attribute of CE is a need to enhance resource efficiency through waste reduction and recycling. CE is based on 3R's concept which leads to extension of the lifecycle of products, leveraging an important component of providing resources for future generations under the broader framework of sustainable development it central to the advancement of intelligent urban areas, the designation "smart cities" The term "smart city" refers to a sustainable city that outperforms efficaciously in myriad dimensions of life. Modern WWTPs are the keystone of supporting sustainability: recycling water, recovering nutrients, and producing energy directly contribute to sustainable development. In this sense, WWTPs become a key element of a smart city, as they have the ability to change waste into resources and could be used in urban development toward less dependence on fossil fuels. However, since emerging contaminants (ECs) in wastewater create the additional challenge associated with wastewater disposal, there is a need for the development of new and innovative techniques of treatment to handle pollution and assure that we attain environmental standards.*

Keywords*: Circular Economy, Environmental pressure, Resource recovery, Smart Cities, Waste Water Treatment Plants (WWTPs).*

Method for treating Methyl Hg contaminated water & soil of Hindon River using Earthworm (as Bioindicator) & Flyash, Biomass & Algae (as adsorbent) and their Management

Pankaj Singh[1,*], Shilpi Singh[2], Gaurav Kumar Rastogi[3], Vivek Singh[4], Abhishek Singh[5], Shruti Singh[6]

[1]Department of Research, R D Engineering College, Ghaziabad, U.P., India
[2]Department of Management, Noida International University, Greater Noida, U.P., India
[3]Department of Applied Science, R D Engineering College, Ghaziabad, U.P., India
[4]Department of Botany- U. P. College, Varanasi, U.P., India
[5]Department of Chemistry- U. P. College, Varanasi, U.P., India
[6]Jonalta School of Medicine, University of Perpetual Help System Dalta, Philippines

**Corresponding Author: p.mnavy@gmail.com*

ABSTRACT: *Mercury contamination in water , soil and air is associated with potential toxicity to humans and ecosystems. Industrial activities (Carbon Continental Company –LalKua-Nainital) such as coal combustion have led to increased mercury (Hg) concentrations in different environmental media. This review critically evaluates recent developments in technological approaches for the remediation of Hg contaminated soil, water and air, with a focus on emerging materials and innovative technologies. Based on approaches including adsorption/desorption, oxidation/reduction and stabilization/containment, the performances of innovative technologies with the aid of these materials were examined. In addition, technologies involving organisms, such as phytoremediation, algae-based mercury removal, microbial reduction and constructed wetlands, were also reviewed, and the role of organisms, especially microorganisms, in these techniques are illustrated. Earthworm intensified the organic loading of wastewater in vermifilter soil bed by the fact that it granulates the clay particles thus increasing the hydraulic conductivity of the system.*

Keywords*: Hg (II) , Methyl mercury ,Elemental mercury, Remediation techniques , Novel materials, Earthworm (E.Feotida) , flyash, Algae and Biomass.*

Development of Low-Cost Ground Water Treatment Using Natural Adsorbent

Neha V. Sonawane*, Shital S. Ajnadkar, Akanksha V. Pisolkar, Snehal N. Chaudhari

Department of Civil Engineering, K.K.Wagh Institute of Engineering Education and Research, Nashik, Maharashtra, India

**Corresponding Author: nv.sonawane@kkwagh.edu.in*

ABSTRACT: *The entire world is facing the issue of water scarcity which is caused by rapid population growth and industrialization. The higher water demand from households and industries is leading to the depletion of freshwater resources, posing a serious threat to sustainable development and human well-being. As well as in India Religious faith and ritual activities lead to significant floral offerings, production and disposal as waste to the nearby open lands or water bodies. Such activities result in various environmental impacts such as water pollution and solid waste generation. The main objective of this work is to utilize the temple waste to develop low-cost methods of groundwater treatment. The present research work is based on the preparation of adsorbents from temple wastes as bel-patra, marigold, and Bermuda grass as natural adsorbents for reducing chloride concentrations and water hardness. To increase the adsorption capacity, acid activation process is used to prepare natural adsorbent. The physical and chemical parameters such as pH, Hardness and Chloride for both the initial groundwater sample and the sample after filtration were analyzed. This study investigates the development of an efficient water-softening method by using natural adsorbents to reduce chloride concentrations and water hardness. This work indicated that adsorbents could be employed as low-cost adsorbents in the removal of chloride content from groundwater.*

Keywords*: Ground water treatment, low cost method, natural adsorbent, temple waste.*

Microbial Approaches to Sustainable Water and Soil Management: Ecological Benefits and Applications

R. Swetha Harini, K. Alekhya, P. Suvarnalatha Devi*

Department of Applied Microbiology, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India

**Corresponding Author: drsuvarnaspmvv@gmail.com*

ABSTRACT: *Microbial interventions play a pivotal role in sustainable water and soil management by enhancing ecological functions and promoting environmental sustainability. This review explores the significant contributions of microorganisms in maintaining the health and productivity of ecosystems, particularly in managing water and soil resources. Microorganisms such as bacteria, fungi, and archaea possess diverse metabolic capabilities that allow them to break down pollutants, cycle nutrients, and improve soil structure, thereby supporting plant growth and improving water quality. In soil ecosystems, microbes contribute to nitrogen fixation, phosphate solubilization, and the degradation of organic matter, enhancing soil fertility and reducing the need for chemical fertilizers. Additionally, microbial interactions with plant roots, known as the rhizosphere effect, play a crucial role in nutrient uptake and stress tolerance, making microbial interventions essential for sustainable agriculture. In water management, microbial processes are employed in bioremediation strategies to treat wastewater, remove heavy metals, and degrade organic pollutants. The application of constructed wetlands, biofilters, and bioreactors harnesses the natural ability of microbes to purify water and restore aquatic ecosystems. Furthermore, microbial interventions contribute to mitigating climate change by promoting carbon sequestration in soils and reducing greenhouse gas emissions. The integration of microbial technologies in sustainable water and soil management holds immense potential for addressing global challenges such as food security, climate change, and pollutants degradation. Future research should focus on optimizing microbial consortia, understanding the ecological functions of microbial communities, and developing scalable applications for diverse ecosystems. Overall, microbial interventions offer a promising approach to fostering environmental sustainability while reducing the reliance on chemical inputs in agriculture and water management.*

Keywords*: Microbial interventions, sustainable water management, ecological functions, bioremediation, nutrient cycling, rhizosphere, carbon sequestration, environmental sustainability, wastewater treatment.*

Life Cycle Assessment (LCA) of Industrial Wastewater Treatment Using Membranes from Mushroom Substrates

Ashwini Modi[1,*], Anand Babu. K.[2]

[1]Mahakal Institute of Technology, Ujjain, India
[2]Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore, India

**Corresponding Author: ashwini.modi1984@gmail.com*

ABSTRACT: *The increasing pollution in various forms—soil, air, and water—and highlights water pollution specifically due to urbanization, industrialization, and population growth. This pollution adversely affects ecosystems, organisms, and agriculture. The study aims to remediate wastewater using mushroom substrates and assess its physio-chemical parameters before and after treatment. Managing mushroom cultivation processes and industrial setups is crucial for minimizing environmental impact and enhancing cultivation under various conditions, which can lead to sustainable and effective solutions in this field. The pollution is increasing very fast in all sense like soil, air, water. This study explores the potential of utilizing spent mushroom substrate (SMS) for wastewater treatment, focusing on its physio-chemical parameters before and after treatment. Furthermore, the study assesses the feasibility of integrating SIMS-based treatment within existing wastewater management frameworks, considering its cost-effectiveness and environmental benefits. This paper examines the application of Life Cycle Assessment (LCA) in evaluating the environmental impacts of industrial wastewater treatment utilizing membranes derived from agricultural waste, specifically mushroom substrates. By integrating sustainable materials into wastewater treatment technologies, we aim to enhance both environmental performance and resource efficiency. Industrial wastewater treatment is crucial for environmental sustainability and compliance with regulatory standards. This paper explores the application of Life Cycle Assessment (LCA) software in evaluating wastewater treatment processes.*

Keywords*: SMS (Spent Mushroom Substrate), MBR (Membrane Bio-Reactor), Life Cycle Assessment (LCA) software, Wastewater, Industrial effluent.*

Enumeration of antibiotic-resistant bacteria in different pond water from West Burdwan district, West Bengal – An indicator of water pollution

Sutripta Sarkar*, Sayani Mukherjee

Department of Food and Nutrition, Barrackpore Rastraguru Surendranath College (affiliated to West Bengal State University), India

**Corresponding Author: sarkar.sutripta@gmail.com*

ABSTRACT: *Water Pollution is a major problem impacting mankind.. Antibiotic-resistant bacteria present a growing concern worldwide due to their implications on public health and the environment. The presence of such bacteria in natural water sources like ponds raises alarms about potential risks to human health and ecosystem stability. When conducting an enumeration of antibiotic-resistant bacteria in pond water from various locations, it is essential to follow a structured approach to gather valuable data. The objectives of this project are to enumerate the total microbial load in pond water sample and to assess abundance of antibiotic-resistant bacterial strains in pond water. The 5 water samples showed total colony counts ranging from 1.4×103 to 11.7×103 CFU/ml in nutrient agar plate which is beyond the acceptable limits sets for microbial quality of pond water. And total colony counts ranging from 0.67×103 to 1×103 CFU/ml in ampicillin plate. When asked, the locals reported that ponds were used for fish cultivation. High relative abundance of antibiotic-resistant bacteria was found in these water samples. The local population who uses the pond water for washing their utensils, cloths, bathing etc. get exposed to antibiotic resistant bacteria and their health become at risk. The antimicrobial activity of unused medicines and their metabolites from fish faeces, even when treated, can remain intact for several months at concentrations high enough to exert a selective pressure on the bacterial diversity in the environment.*

Keywords*: Water Pollution, Antimicrobial resistance, Fish cultivation, SDG 6*

Greywater recycling and reuse in non-potable operations in South Africa: A case study from the Eastern Cape

Siphumze Bani, Roman Tandlich*

Disaster Management and Ethics Research Group (DMERG), Rhodes University

**Corresponding Author: r.tandlich@ru.ac.za*

ABSTRACT: *The current article is aimed at the providing more detail about the possibility to deploy andoperate decentralised systems for greywater treatment in Makana Local Municipality. Background of the municipality is provided in terms of water, sanitation, and hygiene (WASH) situation. In addition, food security of the population, the water scarcity and the challenges in service delivery are analysed. Economics and operational specifics of two filtration systems are modelled, and practical feasibility challenges are analysed. Greywater properties are measured for the possibility to reuse this waste stream in fire-fighting in decentralised settings and water scarcity conditions.*

Keywords*:*

Faecal Sludge management and reuse in South Africa: Risk assessment and potential challenges in application

Phindile Madikizela, Roman Tandlich*
Rhodes University, P.O. Box 94, South Africa
**Corresponding Author: roman.tandlich@gmail.com*

ABSTRACT: *In order to eradicate faecal coliforms from synthetic faeces (SF), which were utilized as a stand-in for actual pit latrine waste, alkali modified coal fly ash (MFA) and unmodified coal fly ash (unMFA) were administered as pit latrine additives in this study. The transformation of quartz and mullite into hydroxysilicate was revealed by the X-ray diffractogram spectrum. Fly ash as a waste product and its carbon footprint, or climate change implications will be discussed for the treatment of the faecal sludge will be discussed. The study will show that MFA and unMFA can be used as pit latrine additives for the removal of pathogenic microorganisms, however, the contents of the pit latrine might have an influence on how fast and effective the additive might be. The broader considerations of the of recycling and the risks implied in the fly ash treated sludge will be discussed and policy changes suggested from the South African point of view..*

Keywords*:*

Sustainable Practices and Perfomances of Dairy Effluent Treatment Plant India

Dineshkumar M[1,*], Sadhan Kumar Ghosh[1,2],Prasanta Kumar Dey[3]
[1]Department of Mechanical Engineering, Jadavpur University, Kolkata, India
[2] President, International Society of Waste Management, Air and Water (ISWMAW), Kolkata, India
[3] Operations Management, Aston Business School, Aston University, UK
**Corresponding Author: kumardk2904@gmail.com*

ABSTRACT: *The dairy is a water-consuming industry that generates huge amounts of effluent and contributes to the most polluting industries. Despite regulatory efforts, in many dairy plants, the effluent management practices often fail to achieve optimal outcomes, generating excessive sludge, missing the resource recovery options, creating an adverse impact on the environment, and questioning the sustainability practice and performance of the DETP. The current literature on DETP sustainability has mostly focused on technical or policy issues often failing to address the industrial driving factors for decision-making to dispose of their effluent. To address the above this study investigates the current performance, and the practice of the DETP focusing on technical, economic, environmental and social aspects, through a systematic literature review, field surveys, and focus group discussions. The study identifies nine key factors. The factors are then validated by gathering opinions from the experts and stakeholders followed by real-time performance observation to gauge the overall sustainability of the operating DETP with the help of case studies on four selected dairy industries located in West Bengal and Gujarat. The findings reveal that understanding the technology plays a vital role in deciding the sustainability of the technology since effluent treatment is not part of their daily business, resulting in them relying on external experts to treat their effluent which often leads to greater energy consumption, poor nutrient recovery, and failing to address their site-specific problems necessitating a tool to assist the industrial expert in knowing their DETP technology. This study offers a novel approach to DETP management that could guide industry stakeholders in achieving environmental compliance while fostering resource recovery..*

Keywords*: Dairy Effluent Treatment plant, Resource Recovery, Design Factors, Sustainability Factors, Decision Making*

Exploring the Potential of Salicornia brachiate Roxb as a Sustainable Solution for Desalination Reject Brine Management to support the coastal region

Dineshkumar M[1,*], Sadhan Kumar Ghosh[1,2],,Prasanta Kumar Dey[3]

[1]Department of Mechanical Engineering, Jadavpur University, Kolkata, India
[2]President, International Society of Waste Management, Air and Water (ISWMAW), Kolkata, India
[3]Operations Management, Aston Business School, Aston University, UK

**Corresponding Author: kumardk2904@gmail.com*

ABSTRACT: *Human anthropogenic activities that disrupt the natural ecosystem for their need have elicited several scarcities for resources, especially water, an epicentre for all the prevailing problems in today's modern world, resulting in the introduction of several desalination technologies on a small scale to quench the water need on community basic which further intern creates numerous environmental issues mainly during the disposal of reject brine highly elevating the salinity of soil and groundwater requests a proper cost-effective, environmentally friendly management system, which enticed us to explore the possibility of harnessing the sustainability of using halophytic plants as a remedial. Though it has several positive social and environmental impacts, the problem is its practical implacability in a diversified environment because of its organic nature, which raises questions about its adaptability to various geographical conditions, especially in coastal regions and its economic sustainability. Based on this, a study considered a halophyte Salicornia brachiate Roxb to treat the rejected brine, reviewing its harvesting and cultivability in the context of Indian Coastal regions and its commercialisation possibilities upon conversion to food, medicine, or energy. This study identifies that adopting Salicornia will be the most effective solution to address the negative impact of brine disposal and could serve as a business*

Keywords*: Brine management, Halophytic plants, Coastal regions, brine assimilation, sustainability.*

Photodegradation of Brilliant Blue Dye using a novel and recyclable Bi2O3 doped TiO2 @ MWCNT catalyst

Pilla Pushpavati*, Alice Rinky Robert, Himavathi Ganja

Department of Chemistry, GITAM School of Sciences, GITAM University, Visakhapatnam, Andhra Pradesh, India

**Corresponding Author: ppushpav@gitam.in*

ABSTRACT: *Multiple water filtration techniques have been developed due to the expanding growth in population and industrialization, which has created it harder to maintain an equitable ratio of water contaminants. Industrial dye waste is particularly hazardous of all the pollutants because of their great stability and resistance to degradation, giving them the catchphrase "persistent organic pollutants." Advanced oxidative process can assist in eliminating undesirable contaminants that are resistant to traditional methods of water treatment. In the present study, we have synthesised mixed oxides catalytic nano composites by doping Bi2O3 / TiO2@ MWCNT with different percentages using Co-precipitation method. The synthesized nano composites have been analyzed using multiple analytical techniques, including BET (Brunauer–Emmett–Teller), SEM (Scanning Electron Microscopy), EDX (Energy Dispersive X-ray Spectrometry), PXRD (Powder X-Ray Diffraction) and TEM (Transmission Electron Microscopy). This doped catalyst is able to degrade an organic dye molecule, Brilliant Blue (BB), under sunlight and ozone by calculating the absorbance using UV Spectrophotometer by collecting the aliquots in 20min interval. The degradation of brilliant blue dye shows highly effiecient results with 20mg/l concentration and 0.025 g/l catalyst dosage , 5% Bi2O3/MWCNT. More than 95% colour removal of brilliant blue dye was achieved with a residence time of 120 min. Dye decolorization also increased with residence time. The advantage of using this advanced oxidation process is the eco-friendly or green nature of the reaction system*

Keywords*: Photo-degradation, UV spectrophotometry, Co-precipitation method, X-ray diffraction.*

Parametric Study on Simultaneous Recovery of Lead and Zinc from Simulated Lead Acid Battery Industry Wastewater by Fluidized Bed Homogeneous Granulation Process

Roselle Y. Mamuad[1,*], Angelo S. Choi[1], Ming-Chun Lu[2]

[1]Department of Chemical Engineering, De La Salle University, Philippines

[2]Department of Environmental Engineering, National Chung Hsing University, Taiwan

**Corresponding Author: lynlei14@gmail.com*

ABSTRACT: *The increasing contamination of water bodies by heavy metals, particularly lead (Pb) and zinc (Zn), poses a significant threat to human health and the environment. This study explores an innovative approach for effectively removing Pb and Zn from simulated lead-acid battery industry wastewater (LABIW) using a fluidized bed homogeneous granulation (FBHG) process. This method involves forming granules within a fluidized bed reactor, presenting a unique and promising technique for enhancing the recovery of metal ions. The study systematically examines the impact of Pb/Zn to precipitant molar ratio on the FBHG process. The results showed that the highest removal efficiency was achieved at a molar ratio of 1.5, the efficiencies were 99.97% for Pb and 99.93% for Zn. Most recovered particles were between 0.104 to 0.42 mm. These particles were smooth, rhombohedral in shape. The findings highlight the effectiveness of the FBHG process in achieving high Zn removal and recovery rates under various conditions. The FBHG process demonstrates significant potential for efficient Zn removal and recovery as Zn carbonate from wastewater. This makes it a promising solution for treating LABIW wastewater and other water treatment applications.*

Keywords*: fluidized bed, homogeneous crystallization, battery industry wastewater, lead, zinc*

Visakhapatnam Special Economic Zone

A Catalyst for Economic Growth

Shri M. Srinivas - IRSME
Zonal Development
Commissioner

VSEZ established in 1989 as one of India's pioneering Export Processing Zones (EPZs) and has evolved into a thriving hub for trade and commerce. Converted into a Special Economic Zone (SEZ) in 2003, VSEZ has been instrumental in driving economic growth in the region. Strategically located on **360** acres of prime land near Duvvada Railway Station, Visakhapatnam, VSEZ offers a range of incentives, concessions, and support services to new, upcoming, and existing units across various sectors. VSEZ's jurisdiction spans across SEZs in Andhra Pradesh, Telangana, Chhattisgarh, and Yanam, with **85** notified SEZs in these states operating under its umbrella. Visakhapatnam Special Economic Zone (VSEZ) offers a strategic location for business success, boasting unbeatable connectivity by air, road, and sea. Its proximity to Visakhapatnam Airport, national highway, and port makes it an ideal destination for trade and commerce. VSEZ features world-class infrastructure, including industrial plots for customized development, ready- to-occupy Standard Design Factory Buildings, and industrial and trading sheds to cater to varied business needs. Essential amenities such as high-speed internet, uninterrupted quality water supply, round-the-clock security, and a dedicated power substation and solar power station ensure seamless operations. To further support businesses, VSEZ provides comprehensive support services, including a business-cum-service centre, in-house customs clearance, single window clearance system, banking, cargo, courier, and postal services within the SEZ. This integrated ecosystem fosters growth, innovation, and sustainability, making VSEZ an attractive destination for businesses to thrive. Units operating within the Visakhapatnam Special Economic Zone (VSEZ) enjoy a range of benefits and incentives that foster growth and success. They are exempt from various duties and fees, including customs and central excise duty, IGST/GST, stamp duty, and registration fee. Additionally, units can clear consignments on self-certification, streamlining their operations and reducing administrative burdens. VSEZ offers highly competitive pricing, with very low lease rentals and statutory fees compared to other industrial areas in the market. This cost-effective environment, combined with the various exemptions and incentives, makes VSEZ an attractive destination for businesses seeking to minimize costs and maximize efficiency. By providing a supportive and conducive environment, VSEZ enables units to thrive and succeed in their respective industries. Andhra Pradesh is home to **25** operational Special Economic Zones (SEZs), with a strong emphasis on the manufacturing sector. These SEZs provide a conducive environment for businesses to thrive, offering various incentives and benefits that foster growth and success. The state's focus on manufacturing reflects its commitment to driving industrial development and creating employment opportunities. With its strategic location, infrastructure, and business-friendly policies, Andhra Pradesh is an attractive destination for investors and entrepreneurs looking to set up operations in the manufacturing sector. The Special Economic Zones (SEZs) initiative has successfully achieved its objectives, driving significant economic growth and development. The program has generated substantial additional economic activity, promoted the export of goods and services, and created numerous employment opportunities. The results are impressive, with exports rising from Rs. 1,80,557 crore in 2022-23 to Rs. 2,24,631 crore in 2023-24 , representing a remarkable growth of 24%. During the current year upto September'2024, the growth momentum has been sustained with exports touching Rs. 1,27,744 crores registering a growth of 22% over previous for the corresponding period. As far as the overall investments are concerned, VSEZ has attracted investments to the tune of Rs 1,12,277 crores as on 31.03.2024 through the setting up of various units and generated jobs to 6,18,551 people as on 31.03.2024. These achievements demonstrate the effectiveness of the SEZs initiative in stimulating economic growth, promoting exports, and creating jobs. The Government has been actively working to enhance the ease and speed of doing business in Special Economic Zones (SEZs) by implementing various initiatives. These include digitization activities, online approvals and clearances of EXIM transactions. To further strengthen the SEZ Scheme, regular meetings are held with all stakeholders to identify and promptly resolve any issues that may arise. Additionally, significant emphasis has been placed on creating and upgrading external infrastructure facilities to support the growth and development of SEZs. These efforts demonstrate the Government's commitment to fostering a conducive business environment and promoting the success of SEZs. ICEGATE has been rolled out across all the SEZs in the country. This initiative is a significant step towards facilitating trade and promoting the growth of SEZs.

VSEZ – ADVANTAGE

Invest in SEZs

- Single Window Mechanism
- Fully operational facilitation Centre for handholding
- No routine Checks by Customs - Clearances on Self Certification
- Large Land Bank in Possession with the Developers

Incentives:

- Exemption from duty on imports/domestic procurement of goods for development, operation and maintenance of SEZ units
- Sales to SEZs are Zero rate under IGST/CGST
- Exemption from Stamp Duty
- Exemption from Registration Charge

Advantage of SEZ :

- Savings in Capex (Import/Indienous)
- Savings in Operational Expenditure
- Savings over entire project life cycle
- Low rentals

Make Money

- Ample Business opportunities outside India, within SEZ and DTAs
- Price competitiveness through reduced duties.

Reduced Risks

- Secured Environment
- Tnter SEZ and Intra SEZ linkages
- Minimal outside regulatory interference

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- Fully functional SEZs with Excellent internal Infrastructure like roads, ETPs, Electricity, Water and Telecommunications
- State Government Attractive incentives & Industrial Friendly policies.
- Availability of Trained and skilled manpower in the vicinity.

Sustainable Waste Management & Circular Economy 2024

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